58P.

NASA TN D-1734

NASA TN D-1734

N63 16711

TECHNICAL NOTE

D-1734

DISPERSION AND DAMPING OF LONGITUDINAL ELECTRON OSCILLATIONS IN THERMAL PLASMAS

By James F. Morris

Lewis Research Center
Cleveland, Ohio

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

WASHINGTON June 1963

I

Code 1

CONTENTS

	Page
SUMMARY	1
INTRODUCTION	1
ANALYSIS	1
Background	1
Quantized Longitudinal Electron Oscillations in a Nondegenerate Plasma	3
Dispersion Equation for Classical Plasma	4
Dispersion Equation for Quantum Plasma	10
DISCUSSION OF QUANTUM DAMPING	16
EFFECTS OF FREQUENCY PERTURBATION ASSUMPTION	18
FORMULAS FOR COMPUTED RESULTS	21
DISCUSSION OF COMPUTED RESULTS	23
APPENDIX - SYMBOLS	25
REFERENCES	27
TABLES	
I - LANDAU DAMPING	29
II - DEGENERACY PROPERTIES OF PLASMAS	29
III - PLASMA DAMPING FUNCTION	30
IV - VALUES OF PARAMETERS FOR $\omega_{qp} = 1.25\ \omega_p$	30
V - DISPERSION AND DAMPING IN A THERMAL PLASMA	31

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

TECHNICAL NOTE D-1734

DISPERSION AND DAMPING OF LONGITUDINAL ELECTRON OSCILLATIONS IN THERMAL PLASMAS

By James F. Morris

SUMMARY

Approximate frequencies and damping factors computed for longitudinal electron oscillations in classical and quantum thermal plasmas are presented; effects of some major assumptions on the values of dispersion variables are discussed. These and some other simple, incidental characteristics of plasmas are tabulated for electron number densities from 10^3 to 10^{24} per cubic centimeter, temperatures from near the "degeneracy" level to 10^{7}° K, and wavelengths from about 1 to 10^5 times the Debye distance.

INTRODUCTION

Direct-energy converters interact plasmas with beams of charged particles and electromagnetic radiation. Therefore, dispersion, damping, and amplification involving longitudinal oscillations of plasma electrons are important effects in energy conversion. These oscillations yield to simple, direct derivations for dispersion and damping in classical and quantum thermal plasmas. However, traditional assumptions seriously affect the values of dispersion variables in important plasma regions. In the present report, these derivations, discussions of major assumptions, and numbers characterizing some of the interactions as functions of plasma conditions are presented.

To preclude excessive permutations, a noncollisional plasma without external fields was analyzed. Electron number densities from 10^3 to 10^{24} per cubic centimeter, temperatures from the degeneracy point, or lower, to 10^{7}° K, and wavelengths from about 1 to 10^5 times the Debye distance were used to compute approximate frequencies and damping factors for longitudinal electron oscillations in plasmas. Coefficiently, some other plasma characteristics that derive directly from electron density, temperature, and/or wavelength were tabulated for convenience.

ANALYSIS

Background

Tonks and Langmuir (ref. 1) revealed that systematic oscillations of elec-

trons occur in cold, quasi-neutral ionized gases; these organized oscillatory motions persist at a "plasma frequency," which is independent of wavelength:

$$\omega_p = \sqrt{4\pi n_e \epsilon^2/m_e} \tag{1}$$

Vlasov (ref. 2) and Bohm and Gross (ref. 3) derived the dispersion relation for longitudinal oscillations in a thermal plasma. This development expressed frequency as a function of electron temperature and wavelength as well as electron density:

$$\omega_{cp} \cong \omega_p\left[1 + \frac{3\kappa T_e}{2m_e}\left(\frac{k}{\omega_p}\right)^2\right] \tag{2}$$

The noncollisional damping equation was provided by Landau (ref. 4):

$$\delta \cong \omega_p\left(\frac{\omega_p}{k}\right)^3\left(\frac{m_e}{\kappa T_e}\right)^{3/2}\left(\frac{\pi}{8}\right)^{1/2} e^{\frac{m_e}{2\kappa T_e}\left(\frac{\omega_p}{k}\right)^2} \tag{3}$$

These are the classics of classical developments for longitudinal plasma oscillations.

Pines and Bohm (ref. 5) introduced the random phase approximation and extended this approach to a quantum treatment of electron behavior at metallic densities (ref. 6). The random phase approximation (refs. 6 to 21) solved the collective Hamiltonian including long-range, linear coupling between electrons and "plasmons." Plasmons are quantized modes of plasma oscillations or low-momentum (long-wavelength) excitations of the electron gas. The long-range electron-plasmon coupling added a quantum correction to the dispersion expression for the classical thermal plasma:

$$\omega_{qp} \cong \omega_{cp} + \frac{\omega_p}{2}\left(\frac{\hbar k^2}{2m_e\omega_p}\right)^2 \tag{4}$$

Where short-range, nonlinear effects ascend, the random phase approximation fails; therefore, in short-wavelength or low-density, zero-temperature limits, the "exchange" frequency shift (refs. 19, 22, and 23) must be tacked on:

$$\Delta\omega_{qp} \cong -\frac{3\omega_p}{40}\left(\frac{k}{K}\right)^2 \tag{5}$$

While this point of strain in the Bohm and Pines presentation attracts much attention, the fact remains that a large part of plasma technology resides in the range of high temperatures. Here the random phase approximation performs adequately for low as well as high densities (refs. 19 and 21).

This paper presents coherent derivations for dispersion and damping of lon-

7

gitudinal oscillations in classical and quantum thermal plasmas. Of course, short-range coulomb interactions were neglected in this high-temperature approximation. A simple physical model yields the integro-dispersion equations directly; then integration proceeds by straightforward expansion techniques. Whenever general characteristics or specific definitions of electron distributions are required, these solutions invoke the Maxwellian approximation of a high-temperature Fermi fluid.

The present approximate solutions for classical dispersion and damping are, of course, identical with the original expressions (refs. 2, 3, and 4). However, solutions based on effectively complete expansions are also presented; these indicate the nature and extent of errors caused by the assumptions used in the original approximate solutions. For the quantum plasma, the present solution yields the Bohm and Pines dispersion relation.

In addition, an apparently new noncollisional damping function results from the complex dispersion equation for longitudinal oscillations in a quantum thermal plasma (ref. 24):

$$\delta_q \cong \delta\left(\frac{2\kappa T_e}{\hbar\omega_p}\right)\sinh\left(\frac{\hbar\omega_p}{2\kappa T_e}\right); \qquad \left(\delta_q \cong \delta \quad \text{for} \quad \frac{2\kappa T_e}{\hbar\omega_p} > 10\right) \tag{6}$$

In the regions of applicability of the present analysis and of many important plasma problems, this damping effect approximates very closely the Landau relation, for temperatures higher than $10\ \hbar\omega_p/(2\kappa)$. However, at temperatures lower than $\hbar\omega_p/(2\kappa)$, quantum damping can be a very important effect in longitudinal electron oscillations of thermal plasmas.

Quantized Longitudinal Electron Oscillations in a Nondegenerate Plasma

Superficially, the title of this section appears veiled in contradiction; however, these shadows fade in the light of various contributions to the random phase approximation (RPA) (refs. 5 to 21). When plasmas are hotter than the degeneracy temperature, nondegenerate electrons oscillate collectively. Indeed, the RPA indicates that long-range interactions should extend the nondegenerate plasma to regions considerably cooler than the degeneracy temperature; furthermore, the RPA decouples long-range (collective oscillations) and short-range (velocity distributions) interactions of the plasma electrons. In addition, accelerations caused by gradients and by oscillations of sizable amplitudes at wavelengths a little longer than the Debye distance should distort any velocity distribution function. For these and other reasons, it seems entirely reasonable to analyze the quantum effects of longitudinal electron oscillations in nondegenerate plasmas and to compare them with the classical case.

Random phase approximation results support separation of collective and individual effects of plasma electrons and representation by classical velocity distributions to lower than degeneracy temperatures. For example, "the collective component and the individual particles component of the density fluctuations

will not be significantly coupled, and thus can be treated independently" (ref. 5, p. 351). Furthermore, the quantum

> "canonical transformation to the collective description provides us with a simple, natural splitup of the interaction between a charged particle and the electron gas into two parts: a short-range interaction with the individual electrons, and the interaction with the collective oscillations of the system as a whole (which has its origin in the long-range electron-electron and electron-particle interactions)." (Ref. 7, p. 633)

These long-range interactions contribute to

> "the result that no 'exchange' contributions to the dispersion relation appear up to order k^4. Physically this result follows from the fact that the long-range correlations act to keep the particles far apart, so that they have less chance to feel the effects of the exclusion principle." (Ref. 6, p. 624)

These and other effective simplifications are reasons for the increased interest in

> "the generalization of the random-phase approximation [RPA] . . . of the electron correlation problem to finite temperature. Since this theory gives the correct high-density limit at zero temperature and both correct high- and low-density behavior in the classical or high-temperature limit, such studies are very much in order." (Ref. 21, p. 1085)

Dispersion Equation for Classical Plasma

This section introduces the dispersion derivation at the more elementary level. The model and method then serve as bases for the quantum plasma development.

In keeping with the simple-minded philosophy of the present approach, the derivations are based on the direction of wave propagation only - hence the ubiquitous subscript k.

Plasma potentials for small disturbances traditionally yield to the trigonometric form:

$$\varphi = \mathrm{Re}\left[\varphi_0 \, e^{i(\bar{k}\cdot\bar{x}-\omega t)}\right] \tag{7}$$

If the coordinates move with the velocity, $\bar{u}_w = \omega\bar{k}/k^2$, of the wave that produces this potential, the time variation disappears:

$$\varphi = \varphi_0 \, e^{i\bar{k}\cdot\bar{x}}$$

For a homogeneous, infinite plasma the time and space variations of the velocity distribution are only those of the wave. Therefore, when the positive

ions are uniformly distributed and effectively at rest, the Boltzmann equation for a collisionless electron gas becomes

$$\frac{\partial f}{\partial t} + \frac{\partial f}{\partial x} u + \frac{\partial f}{\partial u} \frac{du}{dt} = \frac{\partial f(u_{ok})}{\partial x} (u_{ok} - u_w) - \frac{\partial f(u_{ok})}{\partial u}\left(\frac{\epsilon}{m_e} \frac{\partial \varphi}{\partial x}\right) = 0 \tag{9}$$

With Poisson's equation,

$$\frac{\partial}{\partial x} (-\nabla^2\varphi) = ik^3\varphi = 4\pi \frac{\partial \rho}{\partial x} = 4\pi n_e \epsilon \int_{-\infty}^{\infty} \frac{\partial f(u_{ok})}{\partial x} du_{ok} \tag{10}$$

expression (9) reduces to the dispersion equation:

$$i \frac{k\varphi\epsilon}{m_e} \int_{-\infty}^{\infty} \frac{\partial f(u_{ok})}{\partial u_{ok}} \frac{du_{ok}}{u_{ok} - u_w} = \int_{-\infty}^{\infty} \frac{\partial f(u_{ok})}{\partial x} du_{ok} = i \frac{k^3\varphi}{4\pi n_e \epsilon}$$

or

$$1 = \frac{\omega_p^2}{k^2} \int_{-\infty}^{\infty} \frac{\partial f(u_{ok})}{\partial u_{ok}} \frac{du_{ok}}{u_{ok} - u_w} = \frac{\omega_p^2}{k^2}\left[\frac{f(u_{ok})}{u_{ok} - u_w}\Bigg|_{-\infty}^{\infty} + \int_{-\infty}^{\infty} \frac{f(u_{ok})du_{ok}}{(u_{ok} - u_w)^2}\right]$$

$$= \frac{\omega_p^2}{k^2} \int_{-\infty}^{\infty} \frac{f(u_{ok})du_{ok}}{(u_{ok} - u_w)^2} \tag{11}$$

The wave frequency is assumed to have a very small imaginary component, a damping factor:

$$\omega_c = \omega_{cp} - i\delta \qquad (0 < \delta \ll \omega_{cp}) \tag{12}$$

This assumption is justified by the results.

The dispersion equation then takes the form:

$$1 = \frac{\omega_p^2}{k^2} \int_{-\infty}^{\infty} \frac{f(u_{ok})du_{ok}}{\left(u_{ok} - \frac{\omega}{k}\right)^2} = \omega_p^2 \int_{-\infty}^{\infty} \frac{f(u_{ok})du_{ok}}{(ku_{ok} - \omega)^2} = \frac{\omega_p^2}{k^2} \int_{-\infty}^{\infty} \frac{f(u_{ok})du_{ok}}{\frac{2\epsilon}{m_e} \varphi_{max}} \tag{13}$$

For convenience a maximum electron potential is defined as

$$\varphi_{max} = -\frac{m_e}{2\epsilon}(u_{ok} - u_w)^2 \tag{14}$$

This expression must, of course, be analytic over the complex velocity plane.

Equation (13) yields to the following procedures if the number of particles near the singularity $u_{ok} = \omega/k$ and the damping factor are small:

$$1 \cong \frac{\omega_p^2}{k^2}\left[\int_{-\infty}^{(\omega/k)-\alpha} \frac{f(u_{ok})du_{ok}}{\left(u_{ok} - \frac{\omega}{k}\right)^2} + \frac{1}{2}\int_{C_{r=\alpha}} \frac{f(u_{ok})du_{ok}}{\left(u_{ok} - \frac{\omega}{k}\right)^2} + \int_{(\omega/k)+\alpha}^{+\infty} \frac{f(u_{ok})du_{ok}}{\left(u_{ok} - \frac{\omega}{k}\right)^2}\right]$$

$$1 \cong \frac{\omega_p^2}{k^2}\left\{\int_{-\infty}^{+\infty} \frac{f(u_{ok})du_{ok}}{\left(u_{ok} - \frac{\omega}{k}\right)^2} + i\pi\left[\frac{df(u_{ok})}{du_{ok}}\right]_{u_{ok}=(\omega/k)}\right\} \tag{15}$$

Texts on complex variable theory and previous papers on plasma dispersion describe this integration path and technique in detail. Another discourse here would serve little purpose.

If the distribution is near Maxwellian, the contribution of the pole at $u_{ok} = \omega/k$ to the overall integration is a simple one to obtain:

$$i\pi\left[\frac{\omega_p^2}{k^2}\frac{df(u_{ok})}{du_{ok}}\right]_{u_{ok}=(\omega/k)} = -i\pi\left(\frac{\omega_p^2}{k^2}\right)\frac{m_e}{\kappa T_e}\left(\frac{\omega}{k}\right)\sqrt{\frac{m_e}{2\pi\kappa T_e}}\, e^{-\frac{m_e}{2\kappa T_e}\left(\frac{\omega}{k}\right)^2} \tag{16}$$

The rest of the dispersion expression can be expanded and integrated:

$$\frac{\omega_p^2}{k^2}\int_{-\infty}^{+\infty} \frac{f(u_{ok})du_{ok}}{\left(u_{ok} - \frac{\omega}{k}\right)^2} = \frac{\omega_p^2}{\omega^2}\int_{-\infty}^{+\infty} \frac{f(u_{ok})du_{ok}}{\left(1 - \frac{ku_{ok}}{\omega}\right)^2}$$

$$\cong \frac{\omega_p^2}{\omega^2}\int_{-\infty}^{+\infty}\left[1 + 2\frac{ku_{ok}}{\omega} + 3\left(\frac{ku_{ok}}{\omega}\right)^2 + \ldots\right]f(u_{ok})du_{ok}$$

for $|ku_{ok}/\omega| \ll 1$. Because $\langle G_k \rangle = \int G(u_{ok})f(u_{ok})du_{ok}$ and $f(u_{ok})$ is symmetric, $\langle u_{ok}^n \rangle$ disappears for odd values of the integer n. Therefore,

$$\frac{\omega_p^2}{k^2}\int_{-\infty}^{+\infty} \frac{f(u_{ok})du_{ok}}{\left(u_{ok} - \frac{\omega}{k}\right)^2} \cong \frac{\omega_p^2}{\omega^2}\left[1 + 3\left(\frac{k}{\omega}\right)^2 \langle u_{ok}^2 \rangle\right] \tag{17}$$

for $(k/\omega)^2\langle u_{ok}^2 \rangle \ll 1$.

The nature of this approximate solution requires that $\omega^2 \cong \omega_p^2$; so this relation can be used throughout the perturbation terms. In addition, this derivation assigns one degree of freedom to each electron; so

$$3\langle u_{ok}^2 \rangle = \langle u_o^2 \rangle = \frac{3\kappa T_e}{m_e} = 3\omega_p^2\lambda_s^2 \tag{18}$$

The Debye shielding distance is given by

$$\lambda_s = \sqrt{\frac{\kappa T_e}{4\pi n_e \epsilon^2}} = \sqrt{\frac{\kappa T_e}{m_e \omega_p^2}} \tag{19}$$

With these provisions, equations (16) to (19) substituted into (15) yield the integrated dispersion equation:

$$\omega_c^2 \cong \omega_{cp}^2 - 2i\omega_{cp}\delta \cong \omega_p^2\left[1 + 3k^2\lambda_s^2 - i\sqrt{\frac{\pi}{2}}\left(\frac{1}{k\lambda_s}\right)^3 e^{-\frac{1}{2}\left(\frac{1}{k\lambda_s}\right)^2}\right] \tag{20}$$

Equation (43) gives a more complete expansion for this expression. Equation (20) can be separated into real and imaginary parts:

$$\omega_{cp} \cong \left[\omega_p^2\left(1 + 3k^2\lambda_s^2\right)\right]^{1/2} \cong \omega_p\left[1 + \frac{3}{2}(k\lambda_s)^2\right] \tag{21}$$

$$\delta \cong \left(\frac{1}{2i\omega_{cp}}\right)\left[i\omega_p^2\sqrt{\frac{\pi}{2}}\left(\frac{1}{k\lambda_s}\right)^3 e^{-\frac{1}{2}\left(\frac{1}{k\lambda_s}\right)^2}\right] \cong \frac{\omega_p}{(k\lambda_s)^3}\sqrt{\frac{\pi}{8}}\, e^{-\frac{1}{2}\left(\frac{1}{k\lambda_s}\right)^2} \tag{22}$$

Finally, the complex frequency for longitudinal oscillations in a classical

plasma evolves:

$$\omega_c \cong \omega_p \left[1 + \frac{3}{2} (k\lambda_s)^2 - \frac{i}{(k\lambda_s)^3} \sqrt{\frac{\pi}{8}}\, e^{-\frac{1}{2(k\lambda_s)^2}} \right] \tag{23}$$

The group velocity derives from equation (20):

$$\bar{u}_g = \frac{\partial \omega_{cp}}{\partial k} \left(\frac{\bar{k}}{k}\right) = 3\omega_p^2 \lambda_s^2 \left(\frac{k}{\omega_{cp}}\right)\left(\frac{\bar{k}}{k}\right) = \frac{3\omega_p^2 \lambda_s^2}{u_w} \left(\frac{\bar{k}}{k}\right) \tag{24}$$

A more desirable but less direct solution for the dispersion equation (11) begins with the Maxwellian velocity distribution:

$$1 = \frac{\omega_p^2}{k^2} \int_{-\infty}^{\infty} \frac{\partial f(u_{ok})}{\partial u_{ok}} \frac{du_{ok}}{u_{ok} - u_w}$$

$$= - \frac{1}{\pi^{1/2} k^2 \lambda_s^2} \int_{-\infty}^{\infty} \frac{\dfrac{u_{ok}}{2^{1/2}\omega_p \lambda_s} e^{-\frac{u_{ok}^2}{2\omega_p^2 \lambda_s^2}}}{\dfrac{u_{ok}}{2^{1/2}\omega_p \lambda_s} - \dfrac{\frac{\omega}{k}}{2^{1/2}\omega_p \lambda_s}} \frac{du_{ok}}{2^{1/2}\omega_p \lambda_s}$$

$$= - \frac{1}{\pi^{1/2} k^2 \lambda_s^2} \int_{-\infty}^{\infty} \frac{q e^{-q^2}}{q - {}'z}\, dq \tag{11a}$$

Then,

$$\frac{e^{z^2}}{z}\left(k^2\lambda_s^2 + 1\right) = \frac{e^{z^2}}{z}\left[1 - \pi^{-1/2} \int_{-\infty}^{\infty} \left(1 + \frac{{}'z^2}{q - {}'z}\right) e^{-q^2}\, dq\right]$$

$$= \pi^{-1/2} \int_{-\infty}^{\infty} \frac{e^{{}'z^2 - q^2}}{{}'z - q}\, dq \tag{11b}$$

From Leibnitz for

$$h(z) = \int_{\alpha(z)}^{\beta(z)} f('z,q)dq$$

$$\frac{dh(z)}{d'z} = \int_{\alpha}^{\beta} \frac{\partial}{\partial'z} f('z,q)dq + f('z,\beta)\frac{d\beta}{d'z} - f('z,\alpha)\frac{d\alpha}{d'z}$$

which, with $f('z,q) = (e^{'z^2-q^2})/('z - q)$, $\alpha = -\infty$, and $\beta = \infty$, becomes

$$h(z) = \int^{z} \frac{dh('z)}{d'z} d'z = \int^{z} \int_{-\infty}^{\infty} \frac{\partial}{\partial'z}\left(\frac{e^{'z^2-q^2}}{'z - q}\right)dq\ d'z$$

$$= \int^{z} \int_{-\infty}^{\infty} \left(\frac{\partial}{\partial q} + \frac{\partial}{\partial'z}\right)\left(\frac{e^{'z^2-q^2}}{'z - q}\right)dq\ d'z = 2\int^{z} \int_{-\infty}^{\infty} e^{'z^2-q^2}\ dq\ d'z$$

$$= 2\pi^{-1/2} \int^{z} e^{'z^2}\ d'z$$

Therefore, equation (11b) is equivalent to

$$\frac{e^{z^2}}{z}\left(k^2\lambda_s^2 + 1\right) = \pi^{-1/2} \int_{-\infty}^{\infty} \frac{e^{'z^2-q^2}}{'z - q}\ dq = 2\int^{z} e^{'z^2}\ d'z$$

$$= -2i\int_{-(i\infty)}^{(iz)} e^{-(i'z)^2}(i\ d'z) = -i\pi^{1/2}[\mathrm{erf}(iz) + 1]$$

$$= -i\pi^{1/2}[2 - \mathrm{erfc}(iz)] = -i2\pi^{1/2} + 2i\int_{(iz)}^{(i\infty)} e^{-(i'z)^2}(i\ d'z)$$

$$= -i2\pi^{1/2} - 2\int_{z}^{\infty} e^{'z^2}\ d'z \qquad (11c)$$

The integration over (iz) begins at minus infinity where the value of the inte-

gral is zero.

Equation (11c) leads to two expansions:

$$k^2\lambda_s^2 = -i\pi^{1/2}ze^{-z^2} - 1 + 2ze^{-z^2}\int_0^z e^{'z^2}\,d'z$$

$$= -i\pi^{1/2}ze^{-z^2} - 1 + 2z^2\left(1 - \frac{2}{3}z^2 + \frac{2^2}{3\times 5}z^4 - \frac{2^3}{3\times 5\times 7}z^6 + \ldots\right)$$

$$\text{for} \quad z \ll 1 \qquad (11d)$$

$$k^2\lambda_s^2 = -i2\pi^{1/2}ze^{-z^2} - 1 - 2ze^{-z^2}\int_z^\infty e^{'z^2}\,d'z$$

$$= -i2\pi^{1/2}ze^{-z^2} + \frac{1}{2z^2} + \frac{3}{2^2z^4} + \frac{3\times 5}{2^3z^6} + \frac{3\times 5\times 7}{2^4z^8} + \ldots$$

$$\text{for} \quad z \gg 1 \qquad (11e)$$

Of course, if the imaginary part of the complex frequency were positive, the imaginary term of equation (11e) would disappear. If there were no imaginary portion of the complex frequency, the integral coefficient of the imaginary term in equation (11e) would be unity rather than two. Because $\omega \gg \gamma > 0$, the imaginary component of the complex frequency is very near zero by comparison with the real part; therefore, the unit coefficient of the imaginary term of equation (11e) may be appropriately used.

The error function and imaginary terms of equations (11d) and (11e) are tabulated in reference 10, which arrived while this paper was being processed.

Dispersion Equation for Quantum Plasma

The development for dispersion of longitudinal oscillations in a quantum thermal plasma parallels closely that for the classical case. However, in the quantum plasma, the individual electron could convert its velocity $\overline{u}_{ok}$ at $\varphi = 0$ to a maximum potential plus the energy of oscillation within the trough of the wave. The simple quantum theory for a first-state electron in a one-dimensional box with a width of $2\pi/k$ provides the expression for the oscillation energy $\hbar^2k^2/(8m_e)$. Therefore, the maximum potential for an electron changes from that indicated in equation (14) to

$$-\varphi_{max} = \frac{m_e}{2\epsilon}(u_{ok} - u_w)^2 - \frac{\hbar^2k^2}{8m_e\epsilon} = \frac{m_e}{2\epsilon}\left[(u_{ok} - u_w)^2 - \left(\frac{\hbar k}{2m_e}\right)^2\right] \qquad (25)$$

With this exception, the procedure leading to the integro-dispersion equation is identical with that outlined between equations (9) and (13). Equation (13) becomes

$$1 = \frac{\omega_p^2}{k^2} \int_{-\infty}^{+\infty} \frac{f(u_{ok})du_{ok}}{\frac{2\epsilon}{m_e}\varphi_{max}} = \int_{-\infty}^{+\infty} \frac{f(u_{ok})du_{ok}}{(u_{ok} - u_w)^2 - \left(\frac{\hbar k}{2m_e}\right)^2} \tag{26}$$

This expression is identical with that obtained in reference 6.

Again the complex frequency is introduced (similar to eq. (12)):

$$\omega_q = \omega_{qp} - i\delta_q \qquad (0 < \delta_q \ll \omega_{qp}) \tag{27}$$

which yields

$$1 = \frac{\omega_p^2}{k^2} \int_{-\infty}^{+\infty} \frac{f(u_{ok})du_{ok}}{\left(u_{ok} - \frac{\omega_q}{k}\right)^2 - \left(\frac{\hbar k}{2m_e}\right)^2} \tag{28}$$

This indicates an expansion in a vein parallel to equation (15):

$$1 = \frac{\omega_p^2}{k^2}\left[\int_{-\infty}^{\frac{\omega}{k} - \frac{\hbar k}{2m_e} - \alpha} \frac{f(u_{ok})du_{ok}}{(u_{ok} - u_w)^2 - \left(\frac{\hbar k}{2m_e}\right)^2} + \frac{1}{2}\int_{C_{r=\alpha}} \frac{f(u_{ok})du_{ok}}{(u_{ok} - u_w)^2 - \left(\frac{\hbar k}{2m_e}\right)^2}\right.$$

$$+ \int_{\frac{\omega}{k} - \frac{\hbar k}{2m_e} + \alpha}^{\frac{\omega}{k} + \frac{\hbar k}{2m_e} - \alpha} \frac{f(u_{ok})du_{ok}}{(u_{ok} - u_w)^2 - \left(\frac{\hbar k}{2m_e}\right)^2} + \frac{1}{2}\int_{C_{r=\alpha}} \frac{f(u_{ok})du_{ok}}{(u_{ok} - u_w)^2 - \left(\frac{\hbar k}{2m_e}\right)^2}$$

$$\left. + \int_{\frac{\omega}{k} + \frac{\hbar k}{2m_e} + \alpha}^{+\infty} \frac{f(u_{ok})du_{ok}}{(u_{ok} - u_w)^2 - \left(\frac{\hbar k}{2m_e}\right)^2}\right]$$

$$1 \cong \frac{\omega_p^2}{k^2}\left\{\int_{-\infty}^{+\infty} \frac{f(u_{ok})du_{ok}}{(u_{ok} - u_w)^2 - \left(\frac{\hbar k}{2m_e}\right)^2} + i\pi \left.\frac{f(u_{ok})}{u_{ok} - \frac{\omega}{k} - \frac{\hbar k}{2m_e}}\right]_{u_{ok} = \frac{\omega}{k} - \frac{\hbar k}{2m_e}}\right.$$

$$\left. + i\pi \left.\frac{f(u_{ok})}{u_{ok} - \frac{\omega}{k} + \frac{\hbar k}{2m_e}}\right]_{u_{ok} = \frac{\omega}{k} + \frac{\hbar k}{2m_e}}\right\} \tag{29}$$

Then, for a near Maxwellian distribution,

$$i\pi\left(\frac{\omega_p}{k}\right)^2\left\{\left[\frac{f(u_{ok})}{u_{ok} - \frac{\omega}{k} - \frac{\hbar k}{2m_e}}\right]_{u_{ok} = \frac{\omega}{k} - \frac{\hbar k}{2m_e}} + \left[\frac{f(u_{ok})}{u_{ok} - \frac{\omega}{k} + \frac{\hbar k}{2m_e}}\right]_{u_{ok} = \frac{\omega}{k} + \frac{\hbar k}{2m_e}}\right\}$$

$$\cong \frac{i\pi m_e}{\hbar k}\left(\frac{\omega_p}{k}\right)^2 \sqrt{\frac{m_e}{2\pi\kappa T_e}}\; e^{-\frac{m_e}{2\kappa T_e}\left(\frac{\omega}{k}\right)^2}\left(e^{-\frac{\hbar\omega}{2\kappa T_e}} - e^{\frac{\hbar\omega}{2\kappa T_e}}\right)$$

$$= -i\left(\frac{\pi}{2}\right)^{1/2}\left(\frac{2\kappa T_e}{\hbar\omega_p}\right)\left(\frac{m_e}{\kappa T_e}\right)^{3/2}\left(\frac{\omega_p}{k}\right)^3 e^{-\frac{m_e}{2\kappa T_e}\left(\frac{\omega}{k}\right)^2}\left[\sinh\left(\frac{\hbar\omega}{2\kappa T_e}\right)\right]$$

$$\cong -i\left(\frac{\pi}{2}\right)^{1/2}\left(\frac{2\kappa T_e}{\hbar\omega_p}\right)\left(\frac{1}{k\lambda_s}\right)^3 e^{-\frac{1}{2}\left(\frac{1}{k\lambda_s}\right)^2}\left[\sinh\left(\frac{\hbar\omega_p}{2\kappa T_e}\right)\right] \tag{30}$$

In equation (30) $\left(\frac{\hbar k}{2m_e}\right)^2 \ll \left(\frac{\omega}{k}\right)^2$, and the final step involves $\omega \cong \omega_p$, which was also used in the approximate classical case:

$$\left(\frac{\omega_p}{k}\right)^2 \int_{-\infty}^{+\infty} \frac{f(u_{ok})du_{ok}}{(u_{ok} - u_w)^2 - \left(\frac{\hbar k}{2m_e}\right)^2}$$

$$= \left(\frac{\omega_p}{\omega}\right)^2 \int_{-\infty}^{+\infty} \frac{f(u_{ok})du_{ok}}{\left(1 - \frac{ku_{ok}}{\omega}\right)^2 \left\{1 - \left[\frac{\hbar k^2}{2m_e\omega\left(1 - \frac{ku_{ok}}{\omega}\right)}\right]^2\right\}} \tag{31}$$

The denominator here expands and reduces to

$$\frac{1}{\left(1 - \frac{ku_{ok}}{\omega}\right)^2 \left\{1 - \left[\frac{\hbar k^2}{2m_e\omega\left(1 - \frac{ku_{ok}}{\omega}\right)}\right]^2\right\}}$$

$$= \left[1 + 2\frac{ku_{ok}}{\omega} + 3\left(\frac{ku_{ok}}{\omega}\right)^2 + 4\left(\frac{ku_{ok}}{\omega}\right)^3 + \ldots\right]\left\{1 + \left[\frac{\hbar k^2}{2m_e\omega\left(1 - \frac{ku_{ok}}{\omega}\right)}\right]^2 + \left[\frac{\hbar k^2}{2m_e\omega\left(1 - \frac{ku_{ok}}{\omega}\right)}\right]^4 + \ldots\right\}$$

$$\left[1 + 2\frac{ku_{ok}}{\omega} + 3\left(\frac{ku_{ok}}{\omega}\right)^2 + 4\left(\frac{ku_{ok}}{\omega}\right)^3 + \ldots\right]\left\{1 + \left(\frac{\hbar k^2}{2m_e\omega}\right)^2 \left[1 + 2\frac{ku_{ok}}{\omega} + 3\left(\frac{ku_{ok}}{\omega}\right)^2 + 4\left(\frac{ku_{ok}}{\omega}\right)^3 + \ldots\right] + \ldots\right\}$$

$$\cong \left[1 + \left(\frac{\hbar k^2}{2m_e\omega}\right)^2 + \ldots\right] + 2\frac{ku_{ok}}{\omega}\left[1 + \left(\frac{\hbar k^2}{2m_e\omega}\right)^2 + \ldots\right] + 3\left(\frac{ku_{ok}}{\omega}\right)^2\left[1 + \left(\frac{\hbar k^2}{2m_e\omega}\right)^2 + \ldots\right] + \ldots$$

$$\cong 1 + 2\frac{ku_{ok}}{\omega} + 3\left(\frac{ku_{ok}}{\omega}\right)^2 + \left(\frac{\hbar k^2}{2m_e\omega}\right)^2$$

(for the lowest order thermal and quantum effects).

Thus, equation (31) integrates to yield the following approximation:

$$\left(\frac{\omega_p}{k}\right)^2 \int_{-\infty}^{+\infty} \frac{f(u_{ok})du_{ok}}{(u_{ok} - u_w)^2 - \left(\frac{\hbar k}{2m_e}\right)^2}$$

$$\cong \left(\frac{\omega_p}{\omega}\right)^2 \int_{-\infty}^{+\infty} \left[1 + 2\,\frac{ku_{ok}}{\omega} + 3\left(\frac{ku_{ok}}{\omega}\right)^2 + \left(\frac{\hbar k^2}{2m_e\omega}\right)^2\right] f(u_{ok})du_{ok}$$

$$= \left(\frac{\omega_p}{\omega}\right)^2 \left[1 + 3\left(\frac{k}{\omega}\right)^2 \langle u_{ok}^2\rangle + \left(\frac{\hbar k^2}{2m_e\omega}\right)^2\right]$$

$$= \left(\frac{\omega_p}{\omega}\right)^2 \left[1 + \left(\frac{k}{\omega}\right)^2 \langle u_o^2\rangle + \left(\frac{\hbar k^2}{2m_e\omega}\right)^2\right]$$

$$\cong \left(\frac{\omega_p}{\omega}\right)^2 \left[1 + 3k^2\lambda_s^2 + \left(\frac{\hbar\omega_p}{2\kappa T_e}\right)^2 (k\lambda_s)^4\right] \tag{32}$$

for $|ku_{ok}/\omega| \ll 1 \gg [\hbar k^2/(2m_e\omega)]$. Again $\omega \cong \omega_p$ was used in the perturbation terms.

Now the substitution of equations (30) and (32) in (29) yields the integrated dispersion equation for a quantum thermal plasma:

$$\omega_q^2 \cong \omega_{qp}^2 - 2i\omega_{qp}\delta_q \cong \omega_p^2 \left\{1 + 3(k\lambda_s)^2 + \left(\frac{\hbar\omega_p}{2\kappa T_e}\right)^2 (k\lambda_s)^4 - i\sqrt{\frac{\pi}{2}}\left(\frac{2\kappa T_e}{\hbar\omega_p}\right)\left(\frac{1}{k\lambda_s}\right)^3 e^{-\frac{1}{2}\left(\frac{1}{k\lambda_s}\right)^2}\left[\sinh\left(\frac{\hbar\omega_p}{2\kappa T_e}\right)\right]\right\} \tag{33}$$

$$\omega_{qp} \cong \left\{ \omega_p^2 \left[1 + 3(k\lambda_s)^2 + \left(\frac{\hbar\omega_p}{2\kappa T_e}\right)^2 (k\lambda_s)^4 \right] \right\}^{1/2}$$

$$\cong \omega_p \left[1 + \frac{3}{2}(k\lambda_s)^2 + \frac{1}{2}\left(\frac{\hbar\omega_p}{2\kappa T_e}\right)^2 (k\lambda_s)^4 \right] \tag{34}$$

$$\delta_q \cong \left(\frac{1}{2i\omega_{qp}}\right) \left\{ i\omega_p^2 \sqrt{\frac{\pi}{2}} \left(\frac{2\kappa T_e}{\hbar\omega_p}\right) \left(\frac{1}{k\lambda_s}\right)^3 e^{-\frac{1}{2}\left(\frac{1}{k\lambda_s}\right)^2} \left[\sinh\left(\frac{\hbar\omega_p}{2\kappa T_e}\right) \right] \right\}$$

$$\cong \frac{\omega_p}{(k\lambda_s)^3} \sqrt{\frac{\pi}{8}}\, e^{-\frac{1}{2}\left(\frac{1}{k\lambda_s}\right)^2} \left[\left(\frac{2\kappa T_e}{\hbar\omega_p}\right) \sinh\left(\frac{\hbar\omega_p}{2\kappa T_e}\right) \right]$$

$$= \delta \left(\frac{2\kappa T_e}{\hbar\omega_p}\right) \sinh\left(\frac{\hbar\omega_p}{2\kappa T_e}\right) \tag{35}$$

Then the complex frequency for longitudinal oscillations in a quantum plasma results from combining equations (34) and (35):

$$\omega_q = \omega_p \left[1 + \frac{3}{2}(k\lambda_s)^2 + \frac{1}{2}\left(\frac{\hbar\omega_p}{2\kappa T_e}\right)^2 (k\lambda_s)^4 - \frac{i}{(k\lambda_s)^3} \sqrt{\frac{\pi}{8}}\, e^{-\frac{1}{2}\left(\frac{1}{k\lambda_s}\right)^2} \left(\frac{2\kappa T_e}{\hbar\omega_p}\right) \sinh\left(\frac{\hbar\omega_p}{2\kappa T_e}\right) \right] \tag{36}$$

The group velocity results from equation (33):

$$\bar{u}_{qg} \cong \frac{\partial\omega_{qp}}{\partial k}\left(\frac{\bar{k}}{k}\right) = \frac{\bar{k}}{\omega_{qp}}\,(\omega_p\lambda_s)^2\left[3 + 2\left(\frac{\hbar\omega_p}{2\kappa T_e}\right)^2(k\lambda_s)^2\right]$$

$$= \frac{(\omega_p\lambda_s)^2}{u_w}\left[3 + 2\left(\frac{\hbar\omega_p}{2\kappa T_e}\right)^2(k\lambda_s)^2\right]\left(\frac{\bar{k}}{k}\right) \tag{37}$$

DISCUSSION OF QUANTUM DAMPING

An apparently new noncollisional damping relation (eq. (35)) evolved from the complex dispersion equation for longitudinal oscillations in a quantum thermal plasma (ref. 24). This damping factor equals that of Landau multiplied by a function with an argument proportional to the "plasma quantum" divided by the electron thermal energy:

$$\delta_q = \delta\left(\frac{2\kappa T_e}{\hbar\omega_p}\right)\sinh\left(\frac{\hbar\omega_p}{2\kappa T_e}\right) \tag{35}$$

The Landau damping factor δ is well known; it maximizes at

$$\delta_{max} = 0.725\ \omega_p \tag{38}$$

where δ maximizes with respect to each of the independent variables at

$$\left.\begin{aligned} k\Big]_{\delta_{max}} &= \left(\frac{m_e}{3\kappa T_e}\right)^{1/2}\omega_p = \frac{1}{\lambda_s\sqrt{3}} \\ \text{or} \qquad & \\ \lambda_w\Big]_{\delta_{max}} &= 2\pi\sqrt{3}\,\lambda_s \cong 11\lambda_s \end{aligned}\right\} \tag{39}$$

$$\omega_p\Big]_{\delta_{max}} = 2\left(\frac{\kappa T_e}{m_e}\right)^{1/2} k \tag{40}$$

and

$$T_e\Big]_{\delta_{max}} = \frac{m_e}{3\kappa}\left(\frac{\omega_p}{k}\right)^2 \tag{41}$$

This maximum Landau damping factor should cause pause. Two major assump-

tions about the complex frequency precipitated solutions of the integro-dispersion equations and coagulated results suspended in the interdependence of the real and imaginary expressions. First, the imaginary portion (Landau damping factor) of the complex frequency was assumed to be very small compared with the real part. Second, the real part (thermal plasma frequency) of the complex frequency was approximated by the Langmuir-Tonks (zero-temperature) frequency.

These two assumptions ($\delta \ll \omega_{cp}$ and $\omega_{cp} \cong \omega_p$) are traditionally used to obtain solutions for both the thermal plasma frequency and the Landau damping factor; the approximations imply $\delta \ll \omega_p$, which is hardly equivalent to $\delta_{max} = 0.725\ \omega_p$. This problem will be treated in more detail in the next section. However, the Landau damping factor plunges past paucity as any one of its variables moves from the value at the maximum damping factor. This effect is shown in table I, where the ratio of Landau damping factor to Langmuir-Tonks plasma frequency is presented for various values of wavelength divided by the wavelength at maximum damping. Of course, a similar sharp definition of δ_{max} can be shown for λ_s, which includes effects of electron density and temperature. Therefore, the assumption of a very small imaginary term in the complex frequency is, in general, a good approximation.

Three more major assumptions play parts in the developments of both Landau effect and the quantum damping factor. First, small disturbances produce plasma potentials. Second, if the temperature is high enough, the Maxwellian distribution approximates the Fermi fluid. Third, in the perturbation terms of the expansion for the complex frequency, the Langmuir-Tonks value replaces the thermal plasma frequency with little error. This ($\omega_{qp} \cong \omega_p$) might limit the quantum thermal frequency to 1.25 times that of Langmuir-Tonks ($\omega_{qp} \leq 1.25\ \omega_p$).

The Maxwellian substitution implies operation above the degeneracy temperature; however, RPA results indicate that long-range interactions should extend the validity of the classical approximation to temperatures below the degeneracy level. Therefore, a more than safe lower limit for the present derivation is the degeneracy temperature, which is of the order of the Fermi energy divided by the Boltzmann constant:

$$T_e^o = \frac{E_f^o}{\kappa} = \frac{h^2}{2m_e\kappa}\left(\frac{3n_e}{8\pi}\right)^{2/3} \tag{42}$$

Table II records plasma properties computed for various electron densities at the respective degeneracy temperatures.

As electron density drops and/or temperature climbs, δ_q/δ decreases (table III); for temperatures greater than 10 $\hbar\omega_p/(2\kappa)$ (last column of table II), δ_q/δ is effectively unity (table III). Of course, δ_q/δ yields the quantum damping factor when it is multiplied by the Landau relaxation time, which is a function of ω_p and $k\lambda_s$. The wavelength $(2\pi/k)$ of plasma oscillations must be greater than the Debye distance. In addition, k, λ_s, and ω_p are restricted by

the assumption $\omega_{qp} \cong \omega_p$ (arbitrarily, $\omega_{qp} \leq 1.25\ \omega_p$). Some of the limits for $k\lambda_s$ and $\hbar\omega_p/(2\kappa T_e)$ are listed in table IV; these results were obtained by substituting $1.25\ \omega_p$ for ω_{qp} in equation (34).

This discussion indicates the restrictions imposed on the variables of the quantum damping factor by assumptions used in the derivation. The Landau factor can be used as an approximation, where its assumptions apply, for damping of longitudinal electron oscillations in plasmas with electron temperatures higher than $10\ \hbar\omega_p/(2\kappa)$. However, the quantum damping factor must be used for plasma electron temperatures lower than $\hbar\omega_p/(2\kappa)$.

EFFECTS OF FREQUENCY PERTURBATION ASSUMPTION

In the preceding section, it was strongly intimated that the usual approximate solutions for the plasma dispersion equation are badly malformed in a critical region. Near the Landau damping maximum and the Debye distance, the substitution of the Langmuir-Tonks frequency for the thermal plasma frequency in perturbation terms of the expanded solutions fails miserably. Therefore, in this vital area of thermal plasma properties, the frequency and damping factor for longitudinal electron oscillations are unreliable estimates. Furthermore, not far from this location, the Landau damping factor is effectively zero, and the thermal plasma frequency is beautifully approximated by the Langmuir-Tonks value. Thus, the approximate results for plasma dispersion seem to have very limited applicability.

The conventional approximate plasma dispersion solutions invoke the frequency perturbation assumption to decouple and simplify involutions of real and imaginary frequency terms. If the thermal and damping contributions to the complex plasma frequency remain small, the final dispersion expressions are relatively uncomplicated. Then, the terminal expansions for thermal plasma frequency and damping are merely separated and trimmed to the lowest order perturbation terms; as a result, each of ω_{cp} and δ is expressed as the product of the Langmuir-Tonks frequency and a simple function of $k\lambda_s$ (eqs. (21) and (22)). These reduced solutions for ω_{cp} and δ yield a thermal plasma frequency that is 50 percent greater than the zero-temperature plasma frequency at the damping factor maximum ($\omega_{cp} = \frac{3}{2}\omega_p$ at $\delta_{max} = 0.725\ \omega_p$). As the wavelength for plasma electron oscillations decreases from maximum damping toward the Debye distance, the thermal influence on plasma frequency increases strongly. Because this is a particularly pertinent part of plasma properties in energy conversion and other technologies, it would seem that many existing treatments of longitudinal electron oscillations in thermal plasmas quit before they really start. However, if the expanded complex-frequency expressions in their complete forms are solved simultaneously for ω_{cp} and δ, the frequency perturbation assumption $\omega_{cp} \cong \omega_p$ is unnecessary for small k. The following equations show complete expansions for frequency, damping factor, and group velocity for longitudinal electron oscillations in a classical thermal plasma and indicate where the frequency perturbation assumption fails:

$$\omega^2 = \omega_{cp}^2 - 2i\omega_{cp}\delta - \delta^2 = \omega_p^2\left[1 + 3\left(\frac{\omega_p k\lambda_s}{\omega_{cp}}\right)^2 + 5\left(\frac{\omega_p k\lambda_s}{\omega_{cp}}\right)^4 + 7\left(\frac{\omega_p k\lambda_s}{\omega_{cp}}\right)^6 + \ldots\right]$$

$$- \frac{i}{\omega_p}\left(\frac{\pi}{2}\right)^{1/2}\left(\omega_{cp}^3 - 3i\omega_{cp}^2\delta - 3\omega_{cp}\delta^2 + i\delta^3\right)\left(\frac{1}{k\lambda_s}\right)^3 e^{-\frac{\omega_{cp}^2 - 2i\omega_{cp}\delta - \delta^2}{2(\omega_p k\lambda_s)^2}} \tag{43}$$

In this equation the contribution of the imaginary term of the complex frequency is included only in the integration around the pole at $u_{ok} = \omega/k$ (see eqs. (14) to (17)). This approximation is a good one because the real part overwhelms the imaginary portion of the complex frequency everywhere except near the damping factor maximum (table I). Therefore, inclusion of the imaginary term of the complex frequency in the integration that now proceeds along the real axis would greatly complicate the solution without improving it effectively.

Equation (43) can then be separated into its real and imaginary parts. The first yields the classical thermal plasma frequency:

$$\omega_{cp}^2 = \omega_p^2\left[1 + 3\left(\frac{\omega_p k\lambda_s}{\omega_{cp}}\right)^2 + 5\left(\frac{\omega_p k\lambda_s}{\omega_{cp}}\right)^4 + 7\left(\frac{\omega_p k\lambda_s}{\omega_{cp}}\right)^6 + \ldots\right] + \delta^2$$

$$- \frac{\delta(3\omega_{cp}^2 - \delta^2)\cos\frac{\omega_{cp}\delta}{(\omega_p k\lambda_s)^2} - \omega_{cp}(\omega_{cp}^2 - 3\delta^2)\sin\frac{\omega_{cp}\delta}{(\omega_p k\lambda_s)^2}}{\omega_p}$$

$$\times \left(\frac{\pi}{2}\right)^{1/2}\left(\frac{1}{k\lambda_s}\right)^3 e^{-\frac{\omega_{cp}^2 - \delta^2}{2(\omega_p k\lambda_s)^2}} \tag{44}$$

and the second gives the damping factor for a classical thermal plasma:

$$\delta = \frac{\delta(3\omega_{cp}^2 - \delta^2)\sin\frac{\omega_{cp}\delta}{(\omega_p k\lambda_s)^2} + \omega_{cp}(\omega_{cp}^2 - 3\delta^2)\cos\frac{\omega_{cp}\delta}{(\omega_p k\lambda_s)^2}}{\omega_{cp}\omega_p}\left(\frac{\pi}{8}\right)^{1/2}\left(\frac{1}{k\lambda_s}\right)^3 e^{-\frac{\omega_{cp}^2 - \delta^2}{2(\omega_p k\lambda_s)^2}} \tag{45}$$

Equation (44) can then be differentiated with respect to wave number to produce the group velocity for longitudinal electron oscillations in a classical thermal plasma:

$$v_g = \frac{\partial \omega_{cp}}{\partial \kappa}$$

$$= \left[\frac{\left\{ \frac{(\omega_p k\lambda_s)^3}{k}\left(\frac{2}{\pi}\right)^{1/2} e^{-\frac{\omega_{cp}^2-\delta^2}{2(\omega_p k\lambda_s)^2}} \left[3\left(\frac{\omega_p k\lambda_s}{\omega_{cp}}\right)^2 + 10\left(\frac{\omega_p k\lambda_s}{\omega_{cp}}\right)^4 + 21\left(\frac{\omega_p k\lambda_s}{\omega_{cp}}\right)^6 + 36\left(\frac{\omega_p k\lambda_s}{\omega_{cp}}\right)^8 + \ldots\right] + \frac{3}{k}\left[\delta\left(3\omega_{cp}^2 - \delta^2\right)\cos\frac{\delta\omega_{cp}}{(\omega_p k\lambda_s)^2} - \omega_{cp}\left(\omega_{cp}^2 - 3\delta^2\right)\sin\frac{\delta\omega_{cp}}{(\omega_p k\lambda_s)^2}\right] \right.}{\left. - \frac{1}{k(\omega_p k\lambda_s)^2}\left[\delta\left(3\omega_{cp}^4 - 10\delta^2\omega_{cp}^2 + \delta^4\right)\cos\frac{\delta\omega_{cp}}{(\omega_p k\lambda_s)^2} - \omega_{cp}\left(\omega_{cp}^4 - 10\delta^2\omega_{cp}^2 + 5\delta^4\right)\sin\frac{\delta\omega_{cp}}{(\omega_p k\lambda_s)^2}\right]\right\}} \right.$$

$$\left. \frac{\left\{ \frac{(\omega_p k\lambda_s)^3}{\omega_{cp}}\left(\frac{2}{\pi}\right)^{1/2} e^{-\frac{\omega_{cp}^2-\delta^2}{2(\omega_p k\lambda_s)^2}} \left[\left(\frac{\omega_{cp}}{\omega_p}\right)^2 + 3\left(\frac{\omega_p k\lambda_s}{\omega_{cp}}\right)^2 + 10\left(\frac{\omega_p k\lambda_s}{\omega_{cp}}\right)^4 + 21\left(\frac{\omega_p k\lambda_s}{\omega_{cp}}\right)^6 + 36\left(\frac{\omega_p k\lambda_s}{\omega_{cp}}\right)^8 + \ldots\right] - 3\left(\omega_{cp}^2 - \delta^2\right)\sin\frac{\delta\omega_{cp}}{(\omega_p k\lambda_s)^2} + 6\delta\omega_{cp}\cos\frac{\delta\omega_{cp}}{(\omega_p k\lambda_s)^2} \right.}{\left. + \frac{1}{(\omega_p k\lambda_s)^2}\left[\left(\omega_{cp}^4 - 6\omega_{cp}^2\delta^2 + \delta^4\right)\sin\frac{\delta\omega_{cp}}{(\omega_p k\lambda_s)^2} - 4\delta\omega_{cp}\left(\omega_{cp}^2 - \delta^2\right)\cos\frac{\delta\omega_{cp}}{(\omega_p k\lambda_s)^2}\right]\right\}} \right] \tag{46}$$

Equations (44), (45), and (46) can be used to compute approximate values of classical thermal plasma frequency, damping factor, and group velocity for longitudinal electron oscillations without the frequency perturbation assumption. This should indicate the extent of aberration by approximation and reveal whether the simplified theory for the plasma electron oscillations applies in the important region near the damping factor maximum and the Debye distance.

Inverse binomial expansions were used in the integro-dispersion expressions for the present calculations; however, exponential series (eq. (11d)) would have yielded similar results. The same general restrictions apply to both expressions, and both reveal the problems caused by the frequency perturbation assumption.

As it was stated after equation (11e), results for frequency and damping of longitudinal oscillations of plasma electrons are presented in reference 25. There the error function and the imaginary terms of the dispersion equation for a classical thermal plasma (eqs. (11d) and (11e)) are tabulated.

FORMULAS FOR COMPUTED RESULTS

Computed results related to dispersion and damping in classical and quantum thermal plasmas are presented in table V. The formulas for the items recorded in table V are given here in the vertical order of tabulation; where several plasma characteristics exist in one row, these properties are listed in order from left to right before proceeding to the next lower vertical level:

N-E, electron number density, electrons-cm^{-3}, n_e

LAMBDA-I, "plasma lattice spacing," cm between adjacent ions, $\lambda_i = n_e^{-1/3}$

E-F-O, zero-temperature Fermi energy, ev, $E_f^o = \frac{h^2}{2m_e}\left(\frac{3n_e}{8\pi}\right)^{2/3}$

T-E-O, degeneracy temperature, ^oK, $T_e^o = E_f^o/\kappa$

OMEGA-P, Langmuir-Tonks (zero-temperature) plasma frequency, radians-sec^{-1}, $\omega_p = (4\pi n_e \epsilon^2/m_e)^{1/2}$

LAMBDA-OP, free-space wavelength for electromagnetic radiation at zero-temperature plasma frequency, cm, $\lambda_{op} = 2\pi c/\omega_p$

T-E, electron temperature, ^oK, T_e

P-E, electron pressure, atm, $p_e = n_e R T_e/(6.0228\times10^{23})$

LAMBDA-S, Debye distance, cm, $\lambda_s = \left[\kappa T_e/(4\pi n_e \epsilon^2)\right]^{1/2}$

DELTA-Q/DELTA ARG, $\hbar\omega_p/(2\kappa T_e)$

DELTA-Q/DELTA, $\delta_q/\delta = \left[2\kappa T_e/(\hbar\omega_p)\right]\sinh\left[\hbar\omega_p/(2\kappa T_e)\right]$

LAMBDA-W, wavelength of longitudinal electron oscillations in a plasma, cm, λ_w

K, wave number of longitudinal electron oscillations, cm^{-1}, $k = 2\pi/\lambda_w$

OMEGA-O, free-space frequency of electromagnetic radiation having a wavelength equal to that for longitudinal electron oscillations, radians-sec^{-1}, $\omega_o = ck$

EPSILON, plasma dielectric constant, $\epsilon = 1 - \omega_p^2/\omega_o^2$

V-EMP, phase velocity of electromagnetic radiation with a wavelength equal to that for longitudinal electron oscillations, cm-sec^{-1}, $V_{emp} = c/(1 - \omega_p^2/\omega_o^2)^{1/2}$

P, plasma penetration depth for electromagnetic radiation with a wavelength equal to that for the longitudinal electron oscillations (with $\omega_o < \omega_p$), cm, $p = 2\pi c \Big/ \left[\omega_p(1 - \omega_o^2/\omega_p^2)^{1/2}\right]$

OMEGA-CP, approximate classical thermal plasma frequency, radians-sec^{-1}, $\omega_{cp} = \omega_p\left[1 + \frac{3}{2}(k\lambda_s)^2\right]$

OMEGA-CP/OMEGA-P, ω_{cp}/ω_p

LAMBDA-OCP, free-space wavelength for electromagnetic radiation at approximate classical thermal plasma frequency, cm, $\lambda_{ocp} = 2\pi c/\omega_{cp}$

UPSILON-PCP, approximate phase velocity of longitudinal electron wave in a classical thermal plasma, cm-sec^{-1}, $u_{pcp} = \omega_{cp}/k$

UPSILON-GCP, approximate group velocity of longitudinal electron wave in a classical thermal plasma, cm-sec^{-1}, $u_{gcp} = \partial\omega_{cp}/\partial k = 3(\omega_p\lambda_s)^2 k/\omega_{cp}$

DELTA, Landau (approximate classical) damping factor, sec^{-1},

$$\delta = \frac{\omega_p}{(k\lambda_s)^3}\left(\frac{\pi}{8}\right)^{1/2} e^{-\frac{1}{2(k\lambda_s)^2}}$$

DELTA/OMEGA-CP, δ/ω_{cp}

OMEGA-QP, approximate quantum thermal plasma frequency, radians-sec^{-1},

$$\omega_{qp} = \omega_p\left[1 + \frac{3}{2}(k\lambda_s)^2 + \frac{1}{2}\left(\frac{\hbar\omega_p}{2kT_e}\right)^2(k\lambda_s)^4\right]$$

OMEGA-QP/OMEGA-P, ω_{qp}/ω_p

LAMBDA-OQP, free-space wavelength for electromagnetic radiation at approximate quantum thermal plasma frequency, cm, $\lambda_{oqp} = 2\pi c/\omega_{qp}$

UPSILON-PQP, approximate phase velocity of longitudinal electron wave in a quantum thermal plasma, cm-sec^{-1}, $u_{pqp} = \omega_{qp}/k$

UPSILON-GQP, approximate group velocity of longitudinal electron wave in a quantum thermal plasma, cm-sec^{-1}, $u_{gqp} = (k/\omega_{qp})(\omega_p\lambda_s)^2\left[3 + 2\left(\frac{\hbar\omega_p}{2\kappa T_e}\right)^2(k\lambda_s)^2\right]$

DELTA-Q, approximate quantum damping factor, sec^{-1}, $\delta_q = \delta\left(\frac{2\kappa T_e}{\hbar\omega_p}\right)\sinh\left(\frac{\hbar\omega_p}{2\kappa T_e}\right)$

DELTA-Q/OMEGA-QP, δ_q/ω_{qp}

WITHOUT OMEGA-CP $\cong$ OMEGA-P, the following calculations for a classical thermal plasma were made without the simplification of the frequency perturbation assumption:

OMEGA-CP, classical thermal plasma frequency, radians-sec^{-1}, eq. (44)

OMEGA-CP/OMEGA-P, ω_{cp}/ω_p

LAMBDA-OCP, free-space wavelength for electromagnetic radiation at classical thermal plasma frequency, cm, $\lambda_{ocp} = 2\pi c/\omega_{cp}$

UPSILON-PCP, phase velocity of longitudinal electron wave in a classical thermal plasma, cm-sec^{-1}, $u_{pcp} = \omega_{cp}/k$

UPSILON-GCP, group velocity of longitudinal electron wave in a classical thermal plasma, cm-sec^{-1}, eq. (46)

DELTA, damping factor for longitudinal electron oscillations in a classical thermal plasma, sec^{-1}, eq. (45)

DELTA/OMEGA-CP, δ/ω_{cp}

DISCUSSION OF COMPUTED RESULTS

Table V contains computed approximate values of frequency and damping functions for classical and quantum thermal plasmas. Some other plasma characteristics that derive simply from the variables of the dispersion equation are also tabulated. These properties and their defining equations are listed in the preceding section. The results were calculated for electron number densities from 10^3 to 10^{24} per cubic centimeter, temperatures from either 10 or the first integral power of 10 below the degeneracy temperature to 10^{7} K, and wavelengths from just greater than to about 10^5 times the Debye distance.

Table V reveals the regions of plasma conditions where the Langmuir-Tonks

frequency can be used with impunity to approximate the complex plasma frequency. Furthermore, the numbers indicate the limited area in which the frequency perturbation assumption (ω_{cp} or $\omega_{qp} \cong \omega_p$) applies in dispersion expressions for thermal plasmas. The boxes enclose results computed when using the frequency perturbation assumption where it does not hold. This assumption has a pronounced effect on the approximate damping factor; extreme care should be exercised in the application of the simplified damping factors, particularly in view of the fact that they are exponentials.

The Landau damping factor with its limitations can be used for electron temperatures higher than 10 $\hbar\omega_p/(2\kappa)$. However, when temperatures are lower than $\hbar\omega_p/(2\kappa)$, quantum effects of longitudinal electron oscillations must be considered in the damping of these waves.

Finally, values are recorded for a classical thermal plasma computed without the use of the frequency perturbation assumption but with the restrictions of the expansion technique. These can be compared with the more approximate results for the complex frequency. It is also gratifying to note that the damping factor is always small by comparison with the thermal plasma frequency when the frequency perturbation assumption is not used for the classical plasma.

Similar results could have been obtained using exponential rather than inverse binomial series in the expanded dispersion calculations. In any event, it is clear that the frequency perturbation assumption renders the expression for the complex thermal plasma frequency qualitative in the regions where temperature effects are important.

The approximate thermal plasma frequency (refs. 2 and 3) and damping factor (ref. 4) combine simplicity and profundity. Therefore, they are appealing weapons in any assault on plasma dispersion problems; in fact, there is a tendency to wield them with abandon. However, these simplified solutions apply in a very limited region. They fail near the Debye distance and the damping factor maximum. This, unfortunately, is the place where they are needed; not too far from the Landau factor maximum, damping is nil, and the Langmuir-Tonks frequency is an excellent approximation.

For these reasons, the arrival of reference 10, during the final review of the present paper, was particularly propitious. Reference 10 records values of real and imaginary terms resulting from the integration of the error function in the complex plane. These are the numbers to use for safe calculations of classical plasma dispersion effects where damping and thermal influences on frequency are important.

Lewis Research Center
National Aeronautics and Space Administration
Cleveland, Ohio, March 7, 1963

APPENDIX - SYMBOLS

(Symbols for table V are given in section entitled FORMULAS FOR COMPUTED RESULTS)

$C_{r=\alpha}$	indicates integration around the poles on a path with radius $r = \alpha$ in velocity plane
c	speed of electromagnetic radiation in free space
E_f^o	Fermi energy at 0° K
$f(u_{ok})$	zero potential velocity distribution function for dimension containing $\overline{k}$
$\hbar$	Planck constant (h) divided by 2π
K	wave-number equivalent electron momentum at Fermi level
$\overline{k}$	wave vector, given by $2\pi/\lambda$ and having propagation direction
m_e	mass of an electron
n_e	electron number density
R	universal gas constant
T_e	absolute temperature of electrons
T_e^o	degeneracy temperature
t	time
$\overline{u}_g$	classical group velocity
$\overline{u}_{ok}$	zero potential velocity in dimension including wave propagation vector
$\overline{u}_{qg}$	quantum group velocity
$\overline{u}_w$	wave velocity
$\overline{x}$	distance vector in wave propagation dimension
α	very small increment in complex velocity plane
δ	Landau damping factor
δ_q	damping factor for a quantum plasma
ϵ	electronic charge
κ	Boltzmann constant

λ	wavelength
λ_s	Debye shielding distance
ρ_{max}	charge density corresponding to maximum potential
φ	potential
φ_{max}	maximum potential
φ_0	amplitude of potential function
ω_c	complex angular frequency for longitudinal oscillations in a classical thermal plasma
ω_{cp}	angular frequency for longitudinal oscillations in a classical thermal plasma
ω_p	Langmuir-Tonks plasma frequency (for a "cold" plasma)
ω_q	complex angular frequency for longitudinal oscillations in a quantum thermal plasma
ω_{qp}	angular frequency for longitudinal oscillations in a quantum thermal plasma
$]_{\delta_{max}}$	indicates value of preceding variable at δ maximized with respect to preceding variable

REFERENCES

1. Tonks, L., and Langmuir, I.: Oscillations in Ionized Gases. Phys. Rev., vol. 33, 1929, pp. 195-210.

2. Vlasov, A. A.: Vibrational Properties of an Electron Gas. Jour. Exp. Theoretical Phys. (U.S.S.R.), vol. 8, 1938, pp. 291-318.

3. Bohm, D., and Gross, E. P.: Theory of Plasma Oscillations. A. Origin of Medium-Like Behavior. Phys. Rev., vol. 75, no. 12, June 15, 1949, pp. 1851-1876.

4. Landau, L.: Oscillations of an Electron Plasma. Jour. Phys., vol. 10, 1946, p. 25.

5. Pines, David, and Bohm, David: A Collective Description of Electron Interactions: II. Collective vs Individual Particle Aspects of the Interactions. Phys. Rev., vol. 85, no. 2, Jan. 15, 1952, pp. 338-353.

6. Bohm, David, and Pines, David: A Collective Description of Electron Interactions: III. Coulomb Interactions in a Degenerate Electron Gas. Phys. Rev., vol. 92, no. 3, Nov. 1, 1953, pp. 609-625.

7. Pines, David: A Collective Description of Electron Interactions: IV. Electron Interaction in Metals. Phys. Rev., vol. 92, no. 3, Nov. 1, 1953, pp. 626-636.

8. Seitz, Frederick, and Turnbull, D., eds.: Solid State Physics. Academic Press, Inc., 1955.

9. Gell-Mann, Murray, and Brueckner, Keith A.: Correlation Energy of an Electron Gas at High Density. Phys. Rev., vol. 106, no. 2, Apr. 15, 1957, pp. 364-368.

10. Sawada, Katuro: Correlation Energy of an Electron Gas at High Density. Phys. Rev., vol. 106, no. 2, Apr. 15, 1957, pp. 372-383.

11. Sawada, K., Brueckner, K. A., Fukuda, N., and Brout, R.: Correlation Energy of an Electron Gas at High Density: Plasma Oscillations. Phys. Rev., vol. 108, no. 3, Nov. 1, 1957, pp. 507-514.

12. Brout, R.: Correlation Energy of a High-Density Gas: Plasma Coordinates. Phys. Rev., vol. 108, no. 3, Nov. 1, 1957, pp. 515-517.

13. Hubbard, J.: The Description of Collective Motions in Terms of Many-Body Perturbation Theory. Proc. Roy. Soc. (London), ser. A, vol. 240, no. 1223, July 16, 1957, pp. 539-560.

14. Hubbard, J.: The Description of Collective Motions in Terms of Many-Body Perturbation Theory. II. Correlation Energy of a Free-Electron Gas. Proc. Roy. Soc. (London), ser. A, vol. 243, no. 1234, Jan. 14, 1958, pp. 336-352.

15. Nozieres, Philippe, and Pines, David: Electron Interaction in Solids. General Formulation. Phys. Rev., vol. 109, no. 3, Feb. 1, 1958, pp 741-761.

16. Nozieres, Philippe, and Pines, David: Electron Interaction in Solids. Collective Approach to the Dielectric Constant. Phys. Rev., vol. 109, no. 3, Feb. 1, 1958, pp. 762-777.

17. Nozieres, Philippe, and Pines, David: Ground-State Energy and Stopping Power of an Electron Gas. Phys. Rev., vol. 109, no. 3, Feb. 1, 1958, pp. 1009-1010.

18. Nozieres, Philippe, and Pines, David: Electron Interaction in Solids. The Nature of the Elementary Excitations. Phys. Rev., vol. 109, no. 4, Feb. 15, 1958, pp. 1062-1074.

19. Nozieres, P., and Pines, D.: Correlation Energy of a Free Electron Gas. Phys. Rev., vol. 111, no. 2, July 15, 1958, pp. 442-454.

20. Nozieres, P., and Pines, D.: Dielectric Formulation of Many Body Problem: Application to Free Electron Gas. Nuovo Cimento, vol. 9, no. 3, Aug. 1, 1958, pp. 470-480.

21. Englert, F., and Brout, R.: Dielectric Formulation of Quantum Statistics of Interacting Particles. Phys. Rev., vol. 120, no. 4, Nov. 15, 1960, pp. 1085-1092.

22. Silin, V. P.: Collective Losses of Fast Electrons in Passage Through Matter. Soviet Phys. (JETP), vol. 37, no. 1, Jan. 1960, pp. 192-198.

23. von Roos, Oldwig, and Zmudzines, Jonas S.: Effect of Electron Exchange on the Dispersion of Plasmons. Phys. Rev., vol. 121, no. 4, Feb. 15, 1961, pp. 941-942.

24. Morris, James F.: Damping of Quantized Longitudinal Electron Oscillations in a Nondegenerate Plasma. Phys. of Fluids, vol. 5, no. 11, Nov. 1962, pp. 1480-1481.

25. Fried, B. D., and Conte, S. D.: The Plasma Dispersion Function. Academic Press, Inc., 1961.

TABLE I. - LANDAU DAMPING

$\frac{k}{k]_{\delta_{max}}}$	$\frac{\delta}{\omega_p}$
1/5	2.2×10^{-14}
1/3	1.2×10^{-4}
1	7.3×10^{-1}
3	1.0×10^{-1}
5	2.5×10^{-2}
10	3.2×10^{-3}

TABLE II. - DEGENERACY PROPERTIES OF PLASMAS

n_e, cm^{-3}	ω_p, sec^{-1}	E_f^o, ev	T_e^o, ^oK	p_e at T_e^o, atm	λ_s at T_e^o cm	$\frac{\hbar\omega_{p_o}}{2\kappa T_e^o}$	δ_q/δ at T_e^o	$T_e = 10\hbar\omega_p/(2\kappa)$, ^oK
10^{14}	5.64×10^{11}	7.85×10^{-6}	9.11×10^{-2}	1.24×10^{-9}	2.08×10^{-7}	23.6	3.89×10^{8}	2.15×10^{1}
10^{15}	1.78×10^{12}	3.65×10^{-5}	4.23×10^{-1}	5.76×10^{-8}	1.42×10^{-7}	16.1	3.06×10^{5}	6.81×10^{1}
10^{16}	5.64×10^{12}	1.69×10^{-4}	1.96×10^{0}	2.68×10^{-6}	9.67×10^{-8}	11.0	2.65×10^{3}	2.15×10^{2}
10^{17}	1.78×10^{13}	7.85×10^{-4}	9.11×10^{0}	1.24×10^{-4}	6.59×10^{-8}	7.47	1.18×10^{2}	6.81×10^{2}
10^{18}	5.64×10^{13}	3.65×10^{-3}	4.23×10^{1}	5.76×10^{-3}	4.49×10^{-8}	5.09	1.60×10^{1}	2.15×10^{3}
10^{19}	1.78×10^{14}	1.69×10^{-2}	1.96×10^{2}	2.68×10^{-1}	3.06×10^{-8}	3.47	4.62×10^{0}	6.81×10^{3}
10^{20}	5.64×10^{14}	7.85×10^{-2}	9.11×10^{2}	1.24×10^{1}	2.08×10^{-8}	2.36	2.23×10^{0}	2.15×10^{4}
10^{21}	1.78×10^{15}	3.65×10^{-1}	4.23×10^{3}	5.76×10^{2}	1.42×10^{-8}	1.61	1.49×10^{0}	6.81×10^{4}

TABLE III. - PLASMA DAMPING FUNCTION

$\frac{\hbar\omega_p}{2\kappa T_e}$	$\frac{\delta_q}{\delta} = \left(\frac{2\kappa T_e}{\hbar\omega_p}\right)\sinh\left(\frac{\hbar\omega_p}{2\kappa T_e}\right)$
0	1
.01	1.0000
.05	1.0004
.10	1.0017
.50	1.0425
1.00	1.1752
2.00	1.8134
3.00	3.3393
4.00	6.8250
5.00	1.4840×10^{1}
7.00	7.8331×10^{1}
10.00	1.1013×10^{3}
15.00	1.0897×10^{5}
20.00	1.2129×10^{7}
25.00	1.4401×10^{9}
30.00	1.7811×10^{11}
∞	∞

TABLE IV. - VALUES OF PARAMETERS

FOR $\omega_{qp} = 1.25\ \omega_p$

$k\lambda_s$	$\frac{3}{2}(k\lambda_s)^2$	$\frac{\hbar\omega_p}{2\kappa T_e}$
0.408	0.250	0
.40	.240	.884
.35	.184	2.97
.30	.135	5.32
.25	.0937	8.95
.20	.0600	15.4
.15	.0337	29.2
.10	.0150	68.6

TABLE V. - DISPERSION AND DAMPING IN A THERMAL PLASMA

N-E= 1.0E 03
LAMBDA-I= 1.0000000E-01 E-F-0= 3.6457473E-13 T-E-0= 4.2307041E-09 OMEGA-P= 1.7839209E 06 LAMBDA-DP= 1.0558473E 05

T-E= 1.0E 01
P-E= 1.3624228E-18 LAMBDA-S= 6.9014319E-01 DELTA-Q/DELTA ARG= 6.8123070E-07 DELTA-Q/DELTA= 1.0000000E 00

LAMBDA-W	1.0000000E 00	3.0000000E 00	1.0000000E 01	3.0000000E 01	1.0000000E 02	1.0000000E 04
K	6.2831852E 00	2.0943951E 00	6.2831852E-01	2.0943950E-01	6.2831851E-02	6.2831852E-04
OMEGA-0	1.8835481E 11	6.2784937E 10	1.8835481E 10	6.2784936E 09	1.8835481E 09	1.8835481E 07
EPSILON	9.9999999E-01	9.9999999E-01	9.9999998E-01	9.9999992E-01	9.9999909E-01	9.9102988E-01
V-EMP	2.9977600E 10	2.9977600E 10	2.9977600E 10	2.9977601E 10	2.9977613E 10	3.0112962E 10
P						
OMEGA-CP	5.2099789E 07	7.3745729E 06	2.2870795E 06	1.8398274E 06	1.7889524E 06	1.7839213E 06
OMEGA-CP/OMEGA-P	2.9205213E 01	4.1339126E 00	1.2820521E 00	1.0313391E 00	1.0028205E 00	1.0000003E 00
LAMBDA-DCP	3.6152702E 03	2.5541115E 04	8.2356038E 04	1.0237635E 05	1.0528777E 05	1.0558471E 05
UPSILON-PCP	8.2919390E 06	3.5210992E 06	3.6400002E 06	8.7845289E 06	2.8472063E 07	2.8391990E 09
UPSILON-GCP	5.4839658E 05	1.2914350E 06	1.2492502E 06	5.1764540E 05	1.5970992E 05	1.6016034E 03
DELTA	1.3350578E 04	2.9139215E 05	9.5989411E 05	1.4961918E-02	-0.	-0.
DELTA/OMEGA-CP	2.5625014E-04	3.9513087E-02	4.1970298E-01	8.1322398E-09	-0.	-0.
OMEGA-QP	5.2099789E 07	7.3745729E 06	2.2870795E 06	1.8398274E 06	1.7889524E 06	1.7839213E 06
OMEGA-QP/OMEGA-P	2.9205213E 01	4.1339126E 00	1.2820521E 00	1.0313391E 00	1.0028205E 00	1.0000003E 00
LAMBDA-DQP	3.6152701E 03	2.5541115E 04	8.2356038E 04	1.0237635E 05	1.0528777E 05	1.0558470E 05
UPSILON-PQP	8.2919390E 06	3.5210992E 06	3.6400002E 06	8.7845289E 06	2.8472063E 07	2.8391990E 09
UPSILON-GQP	5.4839658E 05	1.2914350E 06	1.2492502E 06	5.1764540E 05	1.5970992E 05	1.6016034E 03
DELTA-Q	1.3350578E 04	2.9139214E 05	9.5989410E 05	1.4961918E-02	-0.	-0.
DELTA-Q/OMEGA-QP	2.5625014E-04	3.9513087E-02	4.1970298E-01	8.1322398E-09	-0.	-0.

WITHOUT OMEGA-CP APPROXIMATELY EQUAL TO OMEGA-P

OMEGA-CP	8.9999999E 06	3.8562500E 06	2.3050781E 06	1.8375000E 06	1.7872210E 06	1.7839210E 06
OMEGA-CP/OMEGA-P	5.0450667E 00	2.1616710E 00	1.2921414E 00	1.0300345E 00	1.0018499E 00	1.0000001E 00
LAMBDA-DCP	2.0928313E 04	4.8844036E 04	8.1712985E 04	1.0250602E 05	1.0538977E 05	1.0558473E 05
UPSILON-PCP	1.4323945E 06	1.8412237E 06	3.6886458E 06	8.7734163E 06	2.8444506E 07	2.8391984E 09
UPSILON-GCP	1.2303834E 06	1.2050963E 06	1.2047329E 06	4.9264549E 05	1.5937534E 05	1.6016037E 03
DELTA	1.7750000E 05	5.9750000E 05	2.3671875E 05	3.6874998E-03	0.	0.
DELTA/OMEGA-CP	1.9722222E-02	1.5494327E-01	1.0269446E-01	2.0068026E-09	0.	0.

N-E= 1.0E 03
LAMBDA-I= 1.0000000E-01 E-F-0= 3.6457473E-13 T-E-0= 4.2307041E-09 OMEGA-P= 1.7839209E 06 LAMBDA-DP= 1.0558473E 05

T-E= 1.0E 02
P-E= 1.3624228E-17 LAMBDA-S= 2.1824244E 00 DELTA-Q/DELTA ARG= 6.8123069E-08 DELTA-Q/DELTA= 1.0000000E 00

LAMBDA-W	3.0000000E 00	1.0000000E 01	3.0000000E 01	1.0000000E 02	1.0000000E 04	1.0000000E 06
K	2.0943951E 00	6.2831852E-01	2.0943950E-01	6.2831851E-02	6.2831852E-04	6.2831852E-06
OMEGA-0	6.2784937E 10	1.8835481E 10	6.2784936E 09	1.8835481E 09	1.8835481E 07	1.8835481E 05
EPSILON	9.9999997E-01	9.9999998E-01	9.9999992E-01	9.9999909E-01	9.9102988E-01	
V-EMP	2.9977600E 10	2.9977600E 10	2.9977601E 10	2.9977613E 10	3.0112962E 10	
P						1.0617824E 05
OMEGA-CP	5.7690442E 07	6.8155077E 06	2.3429861E 06	1.8342367E 06	1.7839259E 06	1.7839209E 06
OMEGA-CP/OMEGA-P	3.2339126E 01	3.8205213E 00	1.3133913E 00	1.0282052E 00	1.0000028E 00	1.0000000E 00
LAMBDA-DCP	3.2649223E 03	2.7636212E 04	8.0390922E 04	1.0268839E 05	1.0558444E 05	1.0558473E 05
UPSILON-PCP	2.7545157E 07	1.0847218E 07	1.1186935E 07	2.9192785E 07	2.8392062E 09	2.8391983E 11
UPSILON-GCP	1.6508423E 06	4.1921082E 06	4.0648053E 06	1.5576695E 06	1.6015994E 04	1.6016039E 02
DELTA	1.1429274E 04	3.3232715E 05	1.0692262E 06	1.2268698E-03	-0.	-0.
DELTA/OMEGA-CP	1.9811382E-04	4.8760438E-02	4.5635193E-01	6.6887211E-10	-0.	-0.
OMEGA-QP	5.7690442E 07	6.8155077E 06	2.3429861E 06	1.8342367E 06	1.7839259E 06	1.7839209E 06
OMEGA-QP/OMEGA-P	3.2339126E 01	3.8205213E 00	1.3133913E 00	1.0282052E 00	1.0000028E 00	1.0000000E 00
LAMBDA-DQP	3.2649223E 03	2.7636211E 04	8.0390922E 04	1.0268839E 05	1.0558444E 05	1.0558473E 05
UPSILON-PQP	2.7545157E 07	1.0847218E 07	1.1186935E 07	2.9192785E 07	2.8392062E 09	2.8391983E 11
UPSILON-GQP	1.6508423E 06	4.1921082E 06	4.0648053E 06	1.5576695E 06	1.6015994E 04	1.6016039E 02
DELTA-Q	1.1429274E 04	3.3232714E 05	1.0692262E 06	1.2268698E-03	-0.	-0.
DELTA-Q/OMEGA-QP	1.9811382E-04	4.8760438E-02	4.5635193E-01	6.6887211E-10	-0.	-0.

WITHOUT OMEGA-CP APPROXIMATELY EQUAL TO OMEGA-P

OMEGA-CP	9.4187499E 06	3.7281250E 06	2.3617187E 06	1.8312500E 06	1.7839210E 06	1.7839210E 06
OMEGA-CP/OMEGA-P	5.2798025E 00	2.0498488E 00	1.3238921E 00	1.0265309E 00	1.0000001E 00	1.0000001E 00
LAMBDA-DCP	1.9997857E 04	5.0522666E 04	7.9753278E 04	1.0285587E 05	1.0558473E 05	1.0558473E 05
UPSILON-PCP	4.4971218E 06	5.9334953E 06	1.1276376E 07	2.9145249E 07	2.8391984E 09	2.8391984E 11
UPSILON-GCP	3.8906365E 06	3.7720943E 06	3.6665719E 06	1.4916179E 06	1.6016046E 04	1.6016036E 02
DELTA	1.6750000E 05	6.3625000E 05	2.7109375E 05	3.0937498E-04	0.	0.
DELTA/OMEGA-CP	1.7781676E-02	1.7066219E-01	1.1478663E-01	1.6894197E-10	0.	0.

TABLE V. - Continued. DISPERSION AND DAMPING IN A THERMAL PLASMA

N-E= 1.0E 03
LAMBDA-I= 1.0000000E-01 E-F-0= 3.6457473E-13 T-E-0= 4.2307041E-09 OMEGA-P= 1.7839209E 06 LAMBDA-CP= 1.0558473E 05

T-E= 1.0E 03
P-E= 1.3624228E-16 LAMBDA-S= 6.9014320E 00 DELTA-Q/DELTA ARG= 6.8123069E-09 DELTA-Q/DELTA= 1.0000000E 00

LAMBDA-W	1.0000000E 01	3.0000000E 01	1.0000000E 02	3.0000000E 02	1.0000000E 04	1.0000000E 06
K	6.2831852E-01	2.0943950E-01	6.2831851E-02	2.0943950E-02	6.2831852E-04	6.2831852E-06
OMEGA-O	1.8835481E 10	6.2784936E 09	1.8835481E 09	6.2784937E 08	1.8835481E 07	1.8835481E 05
EPSILON	9.9999998E-01	9.9999992E-01	9.9999909E-01	9.9999192E-01	9.9102988E-01	
V-EMP	2.9977600E 10	2.9977601E 10	2.9977613E 10	2.9977721E 10	3.0112962E 10	
P						1.0617824E 05
OMEGA-CP	5.2099791E 07	7.3745731E 06	2.2870795E 06	1.8398274E 06	1.7839712E 06	1.7839209E 06
OMEGA-CP/OMEGA-P	2.9205214E 01	4.1339127E 00	1.2620521E 00	1.0313391E 00	1.0000282E 00	1.0000000E 00
LAMBDA-OCP	3.6152700E 03	2.5541114E 04	8.2356038E 04	1.0237635E 05	1.0558176E 05	1.0558473E 05
UPSILON-PCP	8.2919394E 07	3.5210994E 07	3.6400003E 07	8.7845289E 07	2.8392783E 09	2.8391983E 11
UPSILON-GCP	5.4839658E 06	1.2914351E 07	1.2492502E 07	5.1764541E 06	1.6015588E 05	1.6016039E 03
DELTA	1.3350578E 04	2.9139213E 05	9.5989417E 05	1.4961931E-02	-0.	-0.
DELTA/OMEGA-CP	2.5625012E-04	3.9513084E-02	4.1970300E-01	8.1322471E-09	-0.	-0.
OMEGA-QP	5.2099791E 07	7.3745731E 06	2.2870795E 06	1.8398274E 06	1.7839712E 06	1.7839209E 06
OMEGA-QP/OMEGA-P	2.9205214E 01	4.1339127E 00	1.2620521E 00	1.0313391E 00	1.0000282E 00	1.0000000E 00
LAMBDA-OQP	3.6152700E 03	2.5541114E 04	8.2356038E 04	1.0237635E 05	1.0558176E 05	1.0558473E 05
UPSILON-PQP	8.2919394E 07	3.5210994E 07	3.6400003E 07	8.7845289E 07	2.8392783E 09	2.8391983E 11
UPSILON-GQP	5.4839658E 06	1.2914351E 07	1.2492502E 07	5.1764541E 06	1.6015588E 05	1.6016039E 03
DELTA-Q	1.3350578E 04	2.9139213E 05	9.5989414E 05	1.4961931E-02	-0.	-0.
DELTA-Q/OMEGA-QP	2.5625012E-04	3.9513084E-02	4.1970300E-01	8.1322471E-09	-0.	-0.

WITHOUT OMEGA-CP APPROXIMATELY EQUAL TO OMEGA-P

OMEGA-CP	8.9999999E 06	3.8562500E 06	2.3050781E 06	1.8375000E 06	1.7839210E 06	1.7839210E 06
OMEGA-CP/OMEGA-P	5.0450667E 00	2.1616710E 00	1.2921414E 00	1.0300345E 00	1.0000001E 00	1.0000001E 00
LAMBDA-OCP	2.0928313E 04	4.8844036E 04	8.1712985E 04	1.0250602E 05	1.0558473E 05	1.0558473E 05
UPSILON-PCP	1.4323945E 07	1.8412238E 07	3.6686459E 07	8.7734164E 07	2.8391984E 09	2.8391984E 11
UPSILON-GCP	1.2303835E 07	1.2050964E 07	1.2047329E 07	4.9264550E 06	1.6016136E 05	1.6016036E 03
DELTA	1.7750000E 05	5.9750000E 05	2.3671875E 05	3.6874998E-03	0.	0.
DELTA/OMEGA-CP	1.9722222E-02	1.5494327E-01	1.0269446E-01	2.0068026E-09	0.	0.

N-E= 1.0E 03
LAMBDA-I= 1.0000000E-01 E-F-0= 3.6457473E-13 T-E-0= 4.2307041E-09 OMEGA-P= 1.7839209E 06 LAMBDA-CP= 1.0558473E 05

T-E= 1.0E 04
P-E= 1.3624228E-15 LAMBDA-S= 2.1824244E 01 DELTA-Q/DELTA ARG= 6.8123070E-10 DELTA-Q/DELTA= 1.0000000E 00

LAMBDA-W	3.0000000E 01	1.0000000E 02	3.0000000E 02	1.0000000E 03	1.0000000E 04	1.0000000E 06
K	2.0943950E-01	6.2831851E-02	2.0943950E-02	6.2831852E-03	6.2831852E-04	6.2831852E-06
OMEGA-O	6.2784936E 09	1.8835481E 09	6.2784937E 08	1.8835481E 08	1.8835481E 07	1.8835481E 05
EPSILON	9.9999992E-01	9.9999909E-01	9.9999192E-01	9.9991030E-01	9.9102988E-01	
V-EMP	2.9977601E 10	2.9977613E 10	2.9977721E 10	2.9978944E 10	3.0112962E 10	
P						1.0617824E 05
OMEGA-CP	5.7690442E 07	6.8155079E 06	2.3429861E 06	1.8342367E 06	1.7844240E 06	1.7839209E 06
OMEGA-CP/OMEGA-P	3.2339126E 01	3.8205214E 00	1.3133913E 00	1.0282052E 00	1.0002820E 00	1.0000000E 00
LAMBDA-OCP	3.2649223E 03	2.7636211E 04	8.0390922E 04	1.0268839E 05	1.0555496E 05	1.0558473E 05
UPSILON-PCP	2.7545158E 08	1.0447218E 08	1.1186935E 08	2.9192784E 08	2.8399990E 09	2.8391983E 11
UPSILON-GCP	1.6508423E 07	4.1921062E 07	4.0648053E 07	1.5576696E 07	1.6011523E 06	1.6016039E 04
DELTA	1.1429274E 04	3.3232714E 05	1.0692263E 06	1.2268706E-03	-0.	-0.
DELTA/OMEGA-CP	1.9811382E-04	4.8760436E-02	4.5635195E-01	6.6887257E-10	-0.	-0.
OMEGA-QP	5.7690442E 07	6.8155079E 06	2.3429861E 06	1.8342367E 06	1.7844240E 06	1.7839209E 06
OMEGA-QP/OMEGA-P	3.2339126E 01	3.8205214E 00	1.3133913E 00	1.0282052E 00	1.0002820E 00	1.0000000E 00
LAMBDA-OQP	3.2649223E 03	2.7636210E 04	8.0390922E 04	1.0268839E 05	1.0555496E 05	1.0558473E 05
UPSILON-PQP	2.7545158E 08	1.0847218E 08	1.1186935E 08	2.9192784E 08	2.8399990E 09	2.8391983E 11
UPSILON-GQP	1.6508423E 07	4.1921062E 07	4.0648053E 07	1.5576696E 07	1.6011523E 06	1.6016039E 04
DELTA-Q	1.1429274E 04	3.3232714E 05	1.0692263E 06	1.2268706E-03	-0.	-0.
DELTA-Q/OMEGA-QP	1.9811382E-04	4.8760436E-02	4.5635195E-01	6.6887257E-10	-0.	-0.

WITHOUT OMEGA-CP APPROXIMATELY EQUAL TO OMEGA-P

OMEGA-CP	9.4187499E 06	3.7281250E 06	2.3617187E 06	1.8312500E 06	1.7839210E 06	1.7839210E 06
OMEGA-CP/OMEGA-P	5.2798025E 00	2.0898488E 00	1.3238921E 00	1.0265309E 00	1.0000001E 00	1.0000001E 00
LAMBDA-OCP	1.9997857E 04	5.0522666E 04	7.9753278E 04	1.0285587E 05	1.0558473E 05	1.0558473E 05
UPSILON-PCP	4.4971219E 07	5.9334953E 07	1.1276377E 08	2.9145249E 08	2.8391984E 09	2.8391984E 11
UPSILON-GCP	3.8906386E 07	3.7720943E 07	3.6665717E 07	1.4916179E 07	1.6017037E 06	1.6016036E 04
DELTA	1.6750000E 05	6.3625000E 05	2.7109375E 05	3.0937498E-04	0.	0.
DELTA/OMEGA-CP	1.7783676E-02	1.7066219E-01	1.1478663E-01	1.6894197E-10	0.	0.

TABLE V. - Continued. DISPERSION AND DAMPING IN A THERMAL PLASMA

N-E= 1.0E 03
LAMBDA-I= 1.0000000E-01 E-F-0= 3.6457473E-13 T-E-0= 4.2307041E-09 OMEGA-P= 1.7839209E 06 LAMBDA-DP= 1.0558473E 05

T-E= 1.0E 05
P-E= 1.3624226E-14 LAMBDA-S= 6.9014319E 01 DELTA-Q/DELTA ARG= 6.8123069E-11 DELTA-Q/DELTA= 1.0000000E 00

LAMBDA-W	1.0000000E 02	3.0000000E 02	1.0000000E 03	3.0000000E 03	1.0000000E 04	1.0000000E 06
K	6.2831851E-02	2.0943950E-02	6.2831852E-03	2.0943951E-03	6.2831852E-04	6.2831852E-06
OMEGA-0	1.8835481E 09	6.2784937E 08	1.8835481E 08	6.2784938E 07	1.8835481E 07	1.8835481E 05
EPSILON	9.9999909E-01	9.9999192E-01	9.9991030E-01	9.9919268E-01	9.9102988E-01	
V-EMP	2.9977613E 10	2.9977721E 10	2.9978944E 10	2.9989707E 10	3.0112962E 10	
P						1.0617824E 05
OMEGA-CP	5.2094789E 07	7.3745729E 06	2.2870795E 06	1.8398274E 06	1.7889524E 06	1.7839213E 06
OMEGA-CP/OMEGA-P	2.9205213E 01	4.1339126E 00	1.2820521E 00	1.0313391E 00	1.0028205E 00	1.0000003E 00
LAMBDA-DCP	3.6152702E 03	2.5541115E 04	8.2356038E 04	1.0237635E 05	1.0528777E 05	1.0558471E 05
UPSILON-PCP	8.2913391E 08	3.5210992E 08	3.6400002E 08	8.7845287E 08	2.8472063E 09	2.8391990E 11
UPSILON-GCP	5.4839658E 07	1.2914351E 08	1.2492502E 08	5.1764542E 07	1.5970993E 07	1.6016035E 05
DELTA	1.3350578E 04	2.9139215E 05	9.5989412E 05	1.4961931E-02	-0.	-0.
DELTA/OMEGA-CP	2.5625014E-04	3.9513087E-02	4.1970298E-01	8.1322471E-09	-0.	-0.
OMEGA-QP	5.2094789E 07	7.3745729E 06	2.2870795E 06	1.8398274E 06	1.7889524E 06	1.7839213E 06
OMEGA-QP/OMEGA-P	2.9205213E 01	4.1339126E 00	1.2820521E 00	1.0313391E 00	1.0028205E 00	1.0000003E 00
LAMBDA-DQP	3.6152701E 03	2.5541115E 04	8.2356038E 04	1.0237635E 05	1.0528777E 05	1.0558470E 05
UPSILON-PQP	8.2913391E 08	3.5210992E 08	3.6400002E 08	8.7845287E 08	2.8472063E 09	2.8391990E 11
UPSILON-GQP	5.4839658E 07	1.2914351E 08	1.2492502E 08	5.1764542E 07	1.5970993E 07	1.6016035E 05
DELTA-Q	1.3350578E 04	2.9139214E 05	9.5989411E 05	1.4961931E-02	-0.	-0.
DELTA-Q/OMEGA-QP	2.5625014E-04	3.9513087E-02	4.1970298E-01	8.1322471E-09	-0.	-0.

WITHOUT OMEGA-CP APPROXIMATELY EQUAL TO OMEGA-P

OMEGA-CP	8.9999999E 06	3.8562500E 06	2.3050781E 06	1.8375000E 06	1.7872210E 06	1.7839210E 06
OMEGA-CP/OMEGA-P	5.0450667E 00	2.1616710E 00	1.2921414E 00	1.0300345E 00	1.0018499E 00	1.0000001E 00
LAMBDA-DCP	2.0928313E 04	4.8844036E 04	8.1712985E 04	1.0250602E 05	1.0538977E 05	1.0558473E 05
UPSILON-PCP	1.4323945E 08	1.8412238E 08	3.6686458E 08	8.7734163E 08	2.8444506E 09	2.8391984E 11
UPSILON-GCP	1.7303835E 08	1.2050963E 08	1.2047329E 08	4.9264550E 07	1.5937535E 07	1.6016037E 05
DELTA	1.7750000E 05	5.9750000E 05	2.3671875E 05	3.6874998E-03	0.	0.
DELTA/OMEGA-CP	1.9722222E-02	1.5494327E-01	1.0269446E-01	2.0068026E-09	0.	0.

N-E= 1.0E 03
LAMBDA-I= 1.0000000E-01 E-F-0= 3.6457473E-13 T-E-0= 4.2307041E-09 OMEGA-P= 1.7839209E 06 LAMBDA-DP= 1.0558473E 05

T-E= 1.0E 06
P-E= 1.3624227E-13 LAMBDA-S= 2.1624244E 02 DELTA-Q/DELTA ARG= 6.8123070E-12 DELTA-Q/DELTA= 1.0000000E 00

LAMBDA-W	3.0000000E 02	1.0000000E 03	3.0000000E 03	1.0000000E 04	1.0000000E 06
K	2.0943950E-02	6.2831852E-03	2.0943951E-03	6.2831852E-04	6.2831852E-06
OMEGA-0	6.2784937E 08	1.8835481E 08	6.2784938E 07	1.8835481E 07	1.8835481E 05
EPSILON	9.9999192E-01	9.9991030E-01	9.9919268E-01	9.9102988E-01	
V-EMP	2.9977721E 10	2.9978944E 10	2.9989707E 10	3.0112962E 10	
P					1.0617824E 05
OMEGA-CP	5.7690442E 07	6.8155079E 06	2.3429861E 06	1.8342367E 06	1.7839259E 06
OMEGA-CP/OMEGA-P	3.2339126E 01	3.8205214E 00	1.3133913E 00	1.0282052E 00	1.0000028E 00
LAMBDA-DCP	3.2649223E 03	2.7636211E 04	8.0390922E 04	1.0268839E 05	1.0558444E 05
UPSILON-PCP	2.7545158E 09	1.0847218E 09	1.1186934E 09	2.9192784E 09	2.8392063E 11
UPSILON-GCP	1.6508423E 08	4.1921082E 08	4.0048053E 08	1.5576695E 08	1.6015994E 06
DELTA	1.1429274E 04	3.3232714E 05	1.0692263E 06	1.2268706E-03	-0.
DELTA/OMEGA-CP	1.9811382E-04	4.8760436E-02	4.5635195E-01	6.6887257E-10	-0.
OMEGA-QP	5.7690442E 07	6.8155079E 06	2.3429861E 06	1.8342367E 06	1.7839259E 06
OMEGA-QP/OMEGA-P	3.2339126E 01	3.8205214E 00	1.3133913E 00	1.0282052E 00	1.0000028E 00
LAMBDA-DQP	3.2649223E 03	2.7636210E 04	8.0390922E 04	1.0268839E 05	1.0558444E 05
UPSILON-PQP	2.7545158E 09	1.0847218E 09	1.1186934E 09	2.9192784E 09	2.8392063E 11
UPSILON-GQP	1.6508423E 08	4.1921082E 08	4.0048053E 08	1.5576695E 08	1.6015994E 06
DELTA-Q	1.1429274E 04	3.3232714E 05	1.0692263E 06	1.2268706E-03	-0.
DELTA-Q/OMEGA-QP	1.9811382E-04	4.8760436E-02	4.5635195E-01	6.6887257E-10	-0.

WITHOUT OMEGA-CP APPROXIMATELY EQUAL TO OMEGA-P

OMEGA-CP	9.4187499E 06	3.7281250E 06	2.3617187E 06	1.8312500E 06	1.7839210E 06
OMEGA-CP/OMEGA-P	5.2778025E 00	2.0898488E 00	1.3238921E 00	1.0265309E 00	1.0000001E 00
LAMBDA-DCP	1.9997857E 04	5.0522666E 04	7.9753278E 04	1.0285587E 05	1.0558473E 05
UPSILON-PCP	4.4971219E 08	5.9334953E 08	1.1276376E 09	2.9145249E 09	2.8391984E 11
UPSILON-GCP	3.8906385E 08	3.7720944E 08	3.6665718E 08	1.4916180E 08	1.6016045E 06
DELTA	1.6750000E 05	6.3625000E 05	2.7109375E 05	3.0937498E-04	0.
DELTA/OMEGA-CP	1.7783676E-02	1.7066219E-01	1.1478663E-01	1.6894197E-10	0.

TABLE V. - Continued. DISPERSION AND DAMPING IN A THERMAL PLASMA

N-E= 1.0E 03
LAMBDA-I= 1.0000000E-01 E-F-0= 3.6457473E-13 T-E-0= 4.2307041E-09 OMEGA-P= 1.7839209E 06 LAMBDA-DP= 1.0558473E 05

T-E= 1.0E 07
P-E= 1.3624228E-12 LAMBDA-S= 6.9014309E 02 DELTA-Q/DELTA ARG= 6.8123069E-13 DELTA-Q/DELTA= 1.0000000E 00

LAMBDA-W	1.0000000E 03	3.0000000E 03	1.0000000E 04	3.0000000E 04	1.0000000E 06
K	6.2831852E-03	2.0943951E-03	6.2831852E-04	2.0943951E-04	6.2831852E-06
OMEGA-0	1.8835481E 08	6.2784938E 07	1.8835481E 07	6.2784937E 06	1.8835481E 05
EPSILON	9.9991030E-01	9.9919268E-01	9.9102988E-01	9.1926901E-01	
V-EMP	2.9978944E 10	2.9989707E 10	3.0112962E 10	3.1266232E 10	
P					1.0617824E 05
OMEGA-CP	5.2099791E 07	7.3745731E 06	2.2870795E 06	1.8398274E 06	1.7839712E 06
OMEGA-CP/OMEGA-P	2.9205214E 01	4.1339127E 00	1.2820521E 00	1.0313391E 00	1.0000282E 00
LAMBDA-DCP	3.6152700E 03	2.5541114E 04	8.2356038E 04	1.0237635E 05	1.0558176E 05
UPSILON-PCP	8.2919394E 09	3.5210993E 09	3.6400002E 09	8.7845287E 09	2.8392783E 11
UPSILON-GCP	5.4839657E 08	1.2914350E 09	1.2492502E 09	5.1764542E 08	1.6015588E 07
DELTA	1.3350578E 04	2.9139213E 05	9.5989417E 05	1.4961931E-02	-0.
DELTA/OMEGA-CP	2.5625012E-04	3.9513084E-02	4.1970300E-01	8.1322471E-09	-0.
OMEGA-QP	5.2099791E 07	7.3745731E 06	2.2870795E 06	1.8398274E 06	1.7839712E 06
OMEGA-QP/OMEGA-P	2.9205214E 01	4.1339127E 00	1.2820521E 00	1.0313391E 00	1.0000282E 00
LAMBDA-DQP	3.6152700E 03	2.5541114E 04	8.2356038E 04	1.0237635E 05	1.0558176E 05
UPSILON-PQP	8.2919394E 09	3.5210993E 09	3.6400002E 09	8.7845287E 09	2.8392783E 11
UPSILON-GQP	5.4839657E 08	1.2914350E 09	1.2492502E 09	5.1764542E 08	1.6015588E 07
DELTA-Q	1.3350578E 04	2.9139213E 05	9.5989414E 05	1.4961931E-02	-0.
DELTA-Q/OMEGA-QP	2.5625012E-04	3.9513084E-02	4.1970300E-01	8.1322471E-09	-0.

WITHOUT OMEGA-CP APPROXIMATELY EQUAL TO OMEGA-P

OMEGA-CP	8.9999999E 06	3.8562500E 06	2.3050781E 06	1.8375000E 06	1.7839210E 06
OMEGA-CP/OMEGA-P	5.0450667E 00	2.1616710E 00	1.2921414E 00	1.0300345E 00	1.0000001E 00
LAMBDA-DCP	2.0928313E 04	4.8844036E 04	8.1712985E 04	1.0250602E 05	1.0558473E 05
UPSILON-PCP	1.4323945E 09	1.8412237E 09	3.6686458E 09	8.7734163E 09	2.8391984E 11
UPSILON-GCP	1.2303835E 07	1.2050964E 09	1.2047329E 09	4.9264551E 08	1.6016137E 07
DELTA	1.7750000E 05	5.9750000E 05	2.3671875E 05	3.6874998E-03	0.
DELTA/OMEGA-CP	1.9722222E-02	1.5494327E-01	1.0269446E-01	2.0068026E-09	0.

N-E= 1.0E 06
LAMBDA-I= 1.0000001E-02 E-F-0= 3.6457470E-11 T-E-0= 4.2307037E-07 OMEGA-P= 5.6412532E 07 LAMBDA-DP= 3.3388825E 03

T-E= 1.0E 01
P-E= 1.3624228E-15 LAMBDA-S= 2.1824244E-02 DELTA-Q/DELTA ARG= 2.1542406E-05 DELTA-Q/DELTA= 1.0000000E 00

LAMBDA-W	3.0000000E-02	1.0000000E-01	3.0000000E-01	1.0000000E 00	1.0000000E 02	1.0000000E 04
K	2.0943951E 02	6.2831852E 01	2.0943951E 01	6.2831852E 00	6.2831851E-02	6.2831852E-04
OMEGA-0	6.2784937E 12	1.8835481E 12	6.2784938E 11	1.8835481E 11	1.8835481E 09	1.8835481E 07
EPSILON	9.9999999E-01	9.9999999E-01	9.9999998E-01	9.9999989E-01	9.9910299E-01	
V-EMP	2.9977600E 10	2.9977600E 10	2.9977600E 10	2.9977601E 10	2.9991054E 10	
P						3.5421574E 03
OMEGA-CP	1.8243320E 09	2.1552528E 08	7.4091726E 07	5.8003659E 07	5.6412690E 07	5.6412532E 07
OMEGA-CP/OMEGA-P	3.2339127E 01	3.8205214E 00	1.3133913E 00	1.0282052E 00	1.0000028E 00	1.0000000E 00
LAMBDA-DCP	1.0324591E 02	8.7393372E 02	2.5421842E 03	3.2472920E 03	3.3388731E 03	3.3388825E 03
UPSILON-PCP	8.7105438E 06	3.4301915E 06	3.5376193E 06	9.2315689E 06	8.9783587E 08	8.9783332E 10
UPSILON-GCP	5.2204215E 05	1.3256610E 06	1.2854043E 06	4.9257836E 05	5.0647020E 03	5.0647162E 01
DELTA	3.6142537E 05	1.0509107E 07	3.3811903E 07	3.8797056E-02	-0.	-0.
DELTA/OMEGA-CP	1.9811381E-04	4.8760436E-02	4.5635194E-01	6.6887257E-10	-0.	-0.
OMEGA-QP	1.8243320E 09	2.1552528E 08	7.4091726E 07	5.8003659E 07	5.6412690E 07	5.6412532E 07
OMEGA-QP/OMEGA-P	3.2339127E 01	3.8205214E 00	1.3133913E 00	1.0282052E 00	1.0000028E 00	1.0000000E 00
LAMBDA-DQP	1.0324590E 02	8.7393371E 02	2.5421841E 03	3.2472919E 03	3.3388731E 03	3.3388824E 03
UPSILON-PQP	8.7105438E 06	3.4301915E 06	3.5376193E 06	9.2315689E 06	8.9783587E 08	8.9783332E 10
UPSILON-GQP	5.2204215E 05	1.3256610E 06	1.2854043E 06	4.9257836E 05	5.0647020E 03	5.0647162E 01
DELTA-Q	3.6142537E 05	1.0509107E 07	3.3811903E 07	3.8797056E-02	-0.	-0.
DELTA-Q/OMEGA-QP	1.9811381E-04	4.8760436E-02	4.5635194E-01	6.6887257E-10	-0.	-0.

WITHOUT OMEGA-CP APPROXIMATELY EQUAL TO OMEGA-P

OMEGA-CP	2.9781250E 08	1.1789062E 08	7.4687500E 07	5.7937500E 07	5.6412533E 07	5.6412533E 07
OMEGA-CP/OMEGA-P	5.2791904E 00	2.0897949E 00	1.3239523E 00	1.0270324E 00	1.0000000E 00	1.0000000E 00
LAMBDA-DCP	6.3246107E 02	1.5977082E 03	2.5219035E 03	3.2510000E 03	3.3388824E 03	3.3388824E 03
UPSILON-PCP	1.4219499E 06	1.8762876E 06	3.5660654E 06	9.2210394E 06	8.9783337E 08	8.9783335E 10
UPSILON-GCP	1.2306151E 06	1.1929131E 06	1.1595671E 06	4.7102107E 05	5.0647190E 03	5.0647159E 01
DELTA	5.3000000E 06	2.0125000E 07	8.5749999E 06	9.5312489E-03	0.	0.
DELTA/OMEGA-CP	1.7796432E-02	1.7070908E-01	1.1481171E-01	1.6450915E-10	0.	0.

TABLE V. - Continued. DISPERSION AND DAMPING IN A THERMAL PLASMA

N-E= 1.0E 06
LAMBDA-I= 1.0000001E-02 E-F-0= 3.6457470E-11 T-E-0= 4.2307037E-07 OMEGA-P= 5.6412532E 07 LAMBDA-DP= 3.3388825E 03

T-E= 1.0E 02
P-E= 1.3624228E-14 LAMBDA-S= 6.9014320E-02 DELTA-Q/DELTA ARG= 2.1542406E-06 DELTA-Q/DELTA= 1.0000000E 00

LAMBDA-W	1.0000000E-01	3.0000000E-01	1.0000000E 00	3.0000000E 00	1.0000000E 02	1.0000000E 04
K	6.2831852E 01	2.0943951E 01	6.2831852E 00	2.0943951E 00	6.2831851E-02	6.2831852E-04
OMEGA-0	1.8835481E 12	6.2784938E 11	1.8835481E 11	6.2784937E 10	1.8835481E 09	1.8835481E 07
EPSILON	9.9999999E-01	9.9999998E-01	9.9999998E-01	9.9999918E-01	9.9910299E-01	
V-EMP	2.9977600E 10	2.9977600E 10	2.9977601E 10	2.9977612E 10	2.9991054E 10	
P						3.5421574E 03
OMEGA-CP	1.6475401E 09	2.3320448E 08	7.2323807E 07	5.8180451E 07	5.6414122E 07	5.6412532E 07
OMEGA-CP/OMEGA-P	2.9205214E 01	4.1339127E 00	1.2820521E 00	1.0313391E 00	1.0000282E 00	1.0000000E 00
LAMBDA-OCP	1.1432487E 02	8.0768093E 02	2.6043266E 03	3.2374245E 03	3.3387884E 03	3.3388825E 03
UPSILON-PCP	2.6221415E 07	1.1134694E 07	1.1510691E 07	2.7779119E 07	8.9785866E 08	8.9783332E 10
UPSILON-GCP	1.7341822E 06	4.0838763E 06	3.9504762E 06	1.6369386E 06	5.0645736E 04	5.0647164E 02
DELTA	4.2218232E 05	9.2146281E 06	3.0354519E 07	4.7313781E-01	-0.	-0.
DELTA/OMEGA-CP	2.5625010E-04	3.9513083E-02	4.1970300E-01	8.1322471E-09	-0.	-0.
OMEGA-QP	1.6475401E 09	2.3320448E 08	7.2323807E 07	5.8180451E 07	5.6414122E 07	5.6412532E 07
OMEGA-QP/OMEGA-P	2.9205214E 01	4.1339127E 00	1.2820521E 00	1.0313391E 00	1.0000282E 00	1.0000000E 00
LAMBDA-OQP	1.1432487E 02	8.0768092E 02	2.6043265E 03	3.2374244E 03	3.3387883E 03	3.3388824E 03
UPSILON-PQP	2.6221415E 07	1.1134694E 07	1.1510691E 07	2.7779119E 07	8.9785866E 08	8.9783332E 10
UPSILON-GQP	1.7341822E 06	4.0838763E 06	3.9504762E 06	1.6369386E 06	5.0645736E 04	5.0647164E 02
DELTA-Q	4.2218231E 05	9.2146281E 06	3.0354519E 07	4.7313780E-01	-0.	-0.
DELTA-Q/OMEGA-QP	2.5625010E-04	3.9513083E-02	4.1970300E-01	8.1322471E-09	-0.	-0.

WITHOUT OMEGA-CP APPROXIMATELY EQUAL TO OMEGA-P

OMEGA-CP	2.8460937E 08	1.2195313E 08	7.2875000E 07	5.8125000E 07	5.6412533E 07	5.6412533E 07
OMEGA-CP/OMEGA-P	5.0451443E 00	2.1618091E 00	1.2918229E 00	1.0303562E 00	1.0000000E 00	1.0000000E 00
LAMBDA-OCP	6.6180117E 02	1.5444853E 03	2.5846287E 03	3.2405129E 03	3.3388824E 03	3.3388824E 03
UPSILON-PCP	4.5296988E 06	5.8228328E 06	1.1598416E 07	2.7752644E 07	8.9783337E 08	8.9783335E 10
UPSILON-GCP	3.8906938E 06	3.8102396E 06	3.8102728E 06	1.5564710E 06	5.0647479E 04	5.0647159E 02
DELTA	5.6125000E 06	1.8906250E 07	7.4875000E 06	1.1500000E-01	0.	0.
DELTA/OMEGA-CP	1.9720011E-02	1.5502883E-01	1.0274442E-01	1.9784946E-09	0.	0.

N-E= 1.0E 06
LAMBDA-I= 1.0000001E-02 E-F-0= 3.6457470E-11 T-E-0= 4.2307037E-07 OMEGA-P= 5.6412532E 07 LAMBDA-DP= 3.3388825E 03

T-E= 1.0E 03
P-E= 1.3624227E-13 LAMBDA-S= 2.1824244E-01 DELTA-Q/DELTA ARG= 2.1542406E-07 DELTA-Q/DELTA= 1.0000000E 00

LAMBDA-W	3.0000000E-01	1.0000000E 00	3.0000000E 00	1.0000000E 01	1.0000000E 02	1.0000000E 04
K	2.0943951E 01	6.2831852E 00	2.0943951E 00	6.2831852E-01	6.2831851E-02	6.2831852E-04
OMEGA-0	6.2784938E 11	1.8835481E 11	6.2784937E 10	1.8835481E 10	1.8835481E 09	1.8835481E 07
EPSILON	9.9999998E-01	9.9999989E-01	9.9999918E-01	9.9999102E-01	9.9910299E-01	
V-EMP	2.9977600E 10	2.9977601E 10	2.9977612E 10	2.9977734E 10	2.9991054E 10	
P						3.5421574E 03
OMEGA-CP	1.8243320E 07	2.1552528E 08	7.4991726E 07	5.8003659E 07	5.6428443E 07	5.6412532E 07
OMEGA-CP/OMEGA-P	3.2339126E 01	3.8205214E 00	1.3133913E 00	1.0282052E 00	1.0002820E 00	1.0000000E 00
LAMBDA-OCP	1.0324591E 02	8.7393372E 02	2.5421842E 03	3.2472920E 03	3.3379411E 03	3.3388825E 03
UPSILON-PCP	8.7105435E 07	3.4301915E 07	3.5376194E 07	9.2315691E 07	8.9808657E 08	8.9783334E 10
UPSILON-GCP	5.2204217E 06	1.3256610E 07	1.2854043E 07	4.9257835E 06	5.0632882E 05	5.0647162E 03
DELTA	3.6142538E 05	1.0509107E 07	3.3811902E 07	3.8797030E-02	-0.	-0.
DELTA/OMEGA-CP	1.9811382E-04	4.8760436E-02	4.5635193E-01	6.6887211E-10	-0.	-0.
OMEGA-QP	1.8243320E 07	2.1552528E 08	7.4991726E 07	5.8003659E 07	5.6428443E 07	5.6412532E 07
OMEGA-QP/OMEGA-P	3.2339126E 01	3.8205214E 00	1.3133913E 00	1.0282052E 00	1.0002820E 00	1.0000000E 00
LAMBDA-OQP	1.0324591E 02	8.7393371E 02	2.5421841E 03	3.2472919E 03	3.3379410E 03	3.3388824E 03
UPSILON-PQP	8.7105435E 07	3.4301915E 07	3.5376194E 07	9.2315691E 07	8.9808657E 08	8.9783334E 10
UPSILON-GQP	5.2204217E 06	1.3256610E 07	1.2854043E 07	4.9257835E 06	5.0632882E 05	5.0647162E 03
DELTA-Q	3.6142538E 05	1.0509107E 07	3.3811902E 07	3.8797030E-02	-0.	-0.
DELTA-Q/OMEGA-QP	1.9811382E-04	4.8760436E-02	4.5635193E-01	6.6887211E-10	-0.	-0.

WITHOUT OMEGA-CP APPROXIMATELY EQUAL TO OMEGA-P

OMEGA-CP	2.9781250E 08	1.1780062E 08	7.4687500E 07	5.7937500E 07	5.6412533E 07	5.6412533E 07
OMEGA-CP/OMEGA-P	5.2791904E 00	2.0897949E 00	1.3239523E 00	1.0276324E 00	1.0000000E 00	1.0000000E 00
LAMBDA-OCP	6.3246107E 02	1.5977082E 03	2.5219555E 03	3.2510000E 03	3.3388824E 03	3.3388824E 03
UPSILON-PCP	1.4215500E 07	1.8762876E 07	3.5560654E 07	9.2210395E 07	8.9783337E 08	8.9783335E 10
UPSILON-GCP	1.2306151E 07	1.1929131E 07	1.1595671E 07	4.7102108E 06	5.0650326E 05	5.0647159E 03
DELTA	5.3000000E 06	2.0125000E 07	8.5749999E 06	9.5312489E-03	0.	0.
DELTA/OMEGA-CP	1.7796432E-02	1.7070908E-01	1.1481171E-01	1.6450915E-10	0.	0.

TABLE V. - Continued. DISPERSION AND DAMPING IN A THERMAL PLASMA

N-E= 1.0E 06
LAMBDA-I= 1.0000001E-02 E-F-0= 3.6457470E-11 T-E-0= 4.2307037E-07 OMEGA-P= 5.6412532E 07 LAMBDA-DP= 3.3388825E 03

T-E= 1.0E 04
P-E= 1.3624228E-12 LAMBDA-S= 6.9014319E-01 DELTA-Q/DELTA ARG= 2.1542406E-08 DELTA-Q/DELTA= 1.0000000E 00

LAMBDA-W	1.0000000E 00	3.0000000E 00	1.0000000E 01	3.0000000E 01	1.0000000E 02	1.0000000E 04
K	6.2831852E 00	2.0943951E 00	6.2831852E-01	2.0943950E-01	6.2831851E-02	6.2831852E-04
OMEGA-0	1.8835481E 11	6.2784937E 10	1.8835481E 10	6.2784936E 09	1.8835481E 09	1.8835481E 07
EPSILON	9.9999989E-01	9.9999918E-01	9.9999102E-01	9.9991926E-01	9.9910299E-01	
V-EMP	2.9977601E 10	2.9977612E 10	2.9977734E 10	2.9978810E 10	2.9991054E 10	
P						3.5421574E 03
OMEGA-CP	1.6475400E 07	2.3320448E 08	7.2323806E 07	5.8180451E 07	5.6571643E 07	5.6412547E 07
OMEGA-CP/OMEGA-P	2.9205213E 01	4.1339126E 00	1.2820521E 00	1.0313391E 00	1.0028205E 00	1.0000003E 00
LAMBDA-DCP	1.1432488E 02	8.0768095E 02	2.6043266E 03	3.2374245E 03	3.3294916E 03	3.3388816E 03
UPSILON-PCP	2.6221414E 08	1.1134694E 08	1.1510691E 08	2.7779119E 08	9.0036569E 08	8.9783356E 10
UPSILON-GCP	1.7341822E 07	4.0838762E 07	3.9504760E 07	1.6369385E 07	5.0504712E 06	5.0647148E 04
DELTA	4.2218236E 05	9.2146287E 06	3.0354517E 07	4.7313738E-01	-0.	-0.
DELTA/OMEGA-CP	2.5625014E-04	3.9513087E-02	4.1970298E-01	8.1322398E-09	-0.	-0.
OMEGA-QP	1.6475400E 09	2.3320448E 08	7.2323806E 07	5.8180451E 07	5.6571643E 07	5.6412547E 07
OMEGA-QP/OMEGA-P	2.9205213E 01	4.1339126E 00	1.2820521E 00	1.0313391E 00	1.0028205E 00	1.0000003E 00
LAMBDA-DQP	1.1432488E 02	8.0768095E 02	2.6043266E 03	3.2374244E 03	3.3294916E 03	3.3388815E 03
UPSILON-PQP	2.6221414E 08	1.1134694E 08	1.1510691E 08	2.7779119E 08	9.0036569E 08	8.9783356E 10
UPSILON-GQP	1.7341822E 07	4.0838762E 07	3.9504760E 07	1.6369385E 07	5.0504712E 06	5.0647148E 04
DELTA-Q	4.2218235E 05	9.2146287E 06	3.0354517E 07	4.7313738E-01	-0.	-0.
DELTA-Q/OMEGA-QP	2.5625014E-04	3.9513087E-02	4.1970298E-01	8.1322398E-09	-0.	-0.

WITHOUT OMEGA-CP APPROXIMATELY EQUAL TO OMEGA-P

OMEGA-CP	2.8460937E 08	1.2195313E 08	7.2875000E 07	5.8125000E 07	5.6612540E 07	5.6412533E 07
OMEGA-CP/OMEGA-P	5.0451443E 00	2.1618091E 00	1.2918229E 00	1.0303562E 00	1.0035454E 00	1.0000000E 00
LAMBDA-DCP	6.6180117E 02	1.5444853E 03	2.5846287E 03	3.2405129E 03	3.3270864E 03	3.3388824E 03
UPSILON-PCP	4.5296988E 07	5.8228328E 07	1.1598417E 08	2.7752644E 08	9.0101657E 08	8.9783335E 10
UPSILON-GCP	3.8906937E 07	3.8102393E 07	3.8102731E 07	1.5564709E 07	5.0144728E 06	5.0647162E 04
DELTA	5.6125000E 06	1.8906250E 07	7.4875000E 06	1.1500000E-01	0.	0.
DELTA/OMEGA-CP	1.9720011E-02	1.5502883E-01	1.0274442E-01	1.9784946E-09	0.	0.

N-E= 1.0E 06
LAMBDA-I= 1.0000001E-02 E-F-0= 3.6457470E-11 T-E-0= 4.2307037E-07 OMEGA-P= 5.6412532E 07 LAMBDA-DP= 3.3388825E 03

T-E= 1.0E 05
P-E= 1.3624228E-11 LAMBDA-S= 2.1824244E 00 DELTA-Q/DELTA ARG= 2.1542406E-09 DELTA-Q/DELTA= 1.0000000E 00

LAMBDA-W	3.0000000E 00	1.0000000E 01	3.0000000E 01	1.0000000E 02	1.0000000E 04	1.0000000E 06
K	2.0943951E 00	6.2831852E-01	2.0943950E-01	6.2831851E-02	6.2831852E-04	6.2831852E-06
OMEGA-0	6.2784937E 10	1.8835481E 10	6.2784936E 09	1.8835481E 09	1.8835481E 07	1.8835481E 05
EPSILON	9.9999918E-01	9.9999102E-01	9.9991926E-01	9.9910299E-01		
V-EMP	2.9977612E 10	2.9977734E 10	2.9978810E 10	2.9991054E 10		
P					3.5421574E 03	3.3389011E 03
OMEGA-CP	1.8243320E 09	2.1552528E 08	7.4091726E 07	5.8003659E 07	5.6412690E 07	5.6412532E 07
OMEGA-CP/OMEGA-P	3.2339126E 01	3.8205213E 00	1.3133913E 00	1.0282052E 00	1.0000028E 00	1.0000000E 00
LAMBDA-DCP	1.0324591E 02	8.7393373E 02	2.5421841E 03	3.2472920E 03	3.3388731E 03	3.3388825E 03
UPSILON-PCP	8.7105436E 08	3.4301914E 08	3.5376194E 08	9.2315691E 08	8.9783586E 10	8.9783334E 12
UPSILON-GCP	5.2204217E 07	1.3256610E 08	1.2854043E 08	4.9257835E 07	5.0647020E 05	5.0647162E 03
DELTA	3.6142538E 05	1.0509107E 07	3.3811902E 07	3.8797030E-02	-0.	-0.
DELTA/OMEGA-CP	1.9811382E-04	4.8760438E-02	4.5635193E-01	6.6887211E-10	-0.	-0.
OMEGA-QP	1.8243320E 09	2.1552528E 08	7.4091726E 07	5.8003659E 07	5.6412690E 07	5.6412532E 07
OMEGA-QP/OMEGA-P	3.2339126E 01	3.8205213E 00	1.3133913E 00	1.0282052E 00	1.0000028E 00	1.0000000E 00
LAMBDA-DQP	1.0324591E 02	8.7393372E 02	2.5421841E 03	3.2472919E 03	3.3388731E 03	3.3388824E 03
UPSILON-PQP	8.7105436E 08	3.4301914E 08	3.5376194E 08	9.2315691E 08	8.9783586E 10	8.9783334E 12
UPSILON-GQP	5.2204217E 07	1.3256610E 08	1.2854043E 08	4.9257835E 07	5.0647020E 05	5.0647162E 03
DELTA-Q	3.6142538E 05	1.0509107E 07	3.3811902E 07	3.8797030E-02	-0.	-0.
DELTA-Q/OMEGA-QP	1.9811382E-04	4.8760438E-02	4.5635193E-01	6.6887211E-10	-0.	-0.

WITHOUT OMEGA-CP APPROXIMATELY EQUAL TO OMEGA-P

OMEGA-CP	2.9781250E 06	1.1789062E 08	7.4687500E 07	5.7937500E 07	5.6412533E 07	5.6412533E 07
OMEGA-CP/OMEGA-P	5.2791904E 00	2.0897949E 00	1.3239523E 00	1.0270324E 00	1.0000000E 00	1.0000000E 00
LAMBDA-DCP	6.3246107E 02	1.5977082E 03	2.5219055E 03	3.2510000E 03	3.3388824E 03	3.3388824E 03
UPSILON-PCP	1.4219500E 08	1.8762876E 08	3.5660655E 08	9.2210397E 08	8.9783335E 10	8.9783335E 12
UPSILON-GCP	1.2306150E 08	1.1929130E 08	1.1595671E 08	4.7102107E 07	5.0647191E 05	5.0647159E 03
DELTA	5.3000000E 06	2.0125000E 07	8.5749999E 06	9.5312489E-03	0.	0.
DELTA/OMEGA-CP	1.7796432E-02	1.7070908E-01	1.1481171E-01	1.6450915E-10	0.	0.

TABLE V. - Continued. DISPERSION AND DAMPING IN A THERMAL PLASMA

N-E= 1.0E 06
LAMBDA-I= 1.0000001E-02 E-F-0= 3.6457470E-11 T-E-0= 4.2307037E-07 OMEGA-P= 5.6412532E 07 LAMBDA-DP= 3.3388825E 03

T-E= 1.0E 06
P-E= 1.3624227E-10 LAMBDA-S= 6.9014320E 00 DELTA-Q/DELTA ARG= 2.1542406E-10 DELTA-Q/DELTA= 1.0000000E 00

LAMBDA-W	1.0000000E 01	3.0000000E 01	1.0000000E 02	3.0000000E 02	1.0000000E 04	1.0000000E 06
K	6.2831852E-01	2.0943950E-01	6.2831851E-02	2.0943950E-02	6.2831852E-04	6.2831852E-06
OMEGA-0	1.8835481E 10	6.2784936E 09	1.8835481E 09	6.2784937E 08	1.8835481E 07	1.8835481E 05
EPSILON	9.7391026E-01	9.9391926E-01	9.9910299E-01	9.9192690E-01		
V-EMP	2.9978734E 10	2.9978810E 10	2.9991054E 10	3.0099343E 10		
P					3.5421574E 03	3.3389011E 03
OMEGA-CP	1.6473461E 09	2.3320448E 08	7.2323806E 07	5.8180451E 07	5.6414122E 07	5.6412532E 07
OMEGA-CP/OMEGA-P	2.9205214E 01	4.1339127E 00	1.2820521E 00	1.0313391E 00	1.0000282E 00	1.0000000E 00
LAMBDA-DCP	1.1432488E 02	8.0768093E 02	2.6043266E 03	3.2374245E 03	3.3387884E 03	3.3388825E 03
DPSILON-PCP	2.6221415E 09	1.1134674E 09	1.1510691E 09	2.7779119E 09	8.9785863E 10	8.9783334E 12
DPSILON-DCP	1.7341822E 08	4.0838763E 08	3.9504762E 08	1.6369386E 08	5.0645736E 06	5.0647163E 04
DELTA	4.2218233E 05	9.2146283E 06	3.0354518E 07	4.7313781E-01	-0.	-0.
DELTA/OMEGA-CP	2.5625012E-04	3.9513084E-02	4.1970300E-01	8.1322471E-09	-0.	-0.
OMEGA-WP	1.6473461E 09	2.3320448E 08	7.2323806E 07	5.8180451E 07	5.6414122E 07	5.6412532E 07
OMEGA-WP/OMEGA-P	2.9205214E 01	4.1339127E 00	1.2820521E 00	1.0313391E 00	1.0000282E 00	1.0000000E 00
LAMBDA-DWP	1.1432488E 02	8.0768093E 02	2.6043266E 03	3.2374244E 03	3.3387883E 03	3.3388824E 03
DPSILON-PWP	2.6221415E 09	1.1134674E 09	1.1510691E 09	2.7779119E 09	8.9785863E 10	8.9783334E 12
DPSILON-DWP	1.7341822E 08	4.0838763E 08	3.9504762E 08	1.6369386E 08	5.0645736E 06	5.0647163E 04
DELTA-Q	4.2218233E 05	9.2146282E 06	3.0354518E 07	4.7313780E-01	-0.	-0.
DELTA-Q/OMEGA-WP	2.5625012E-04	3.9513084E-02	4.1970300E-01	8.1322471E-09	-0.	-0.

WITHOUT OMEGA-CP APPROXIMATELY EQUAL TO OMEGA-P

OMEGA-CP	2.8460937E 08	1.2195313E 08	7.2875000E 07	5.8125000E 07	5.6412533E 07	5.6412533E 07
OMEGA-CP/OMEGA-P	5.0451443E 00	2.1618091E 00	1.2918229E 00	1.0303562E 00	1.0000000E 00	1.0000000E 00
LAMBDA-DCP	6.6186117E 02	1.5444853E 03	2.5846287E 03	3.2405129E 03	3.3388824E 03	3.3388824E 03
DPSILON-PCP	4.5296988E 08	5.8228329E 08	1.1598417E 09	2.7752643E 09	8.9783335E 10	8.9783335E 12
DPSILON-DCP	3.8506938E 08	3.8102374E 08	3.8102729E 08	1.5564710E 08	5.0647478E 06	5.0647159E 04
DELTA	5.6125000E 06	1.8906250E 07	7.4875000E 06	1.1500000E-01	0.	0.
DELTA/OMEGA-CP	1.9720011E-02	1.5502883E-01	1.0274442E-01	1.9784946E-09	0.	0.

N-E= 1.0E 06
LAMBDA-I= 1.0000001E-02 E-F-0= 3.6457470E-11 T-E-0= 4.2307037E-07 OMEGA-P= 5.6412532E 07 LAMBDA-DP= 3.3388825E 03

T-E= 1.0E 07
P-E= 1.3624228E-09 LAMBDA-S= 2.1824244E 01 DELTA-Q/DELTA ARG= 2.1542406E-11 DELTA-Q/DELTA= 1.0000000E 00

LAMBDA-W	3.0000000E 01	1.0000000E 02	3.0000000E 02	1.0000000E 03	1.0000000E 04	1.0000000E 06
K	2.0943950E-01	6.2831851E-02	2.0943950E-02	6.2831852E-03	6.2831852E-04	6.2831852E-06
OMEGA-0	6.2784936E 09	1.8835481E 09	6.2784937E 08	1.8835481E 08	1.8835481E 07	1.8835481E 05
EPSILON	9.9391926E-01	9.9910299E-01	9.9192690E-01	9.1027890E-01		
V-EMP	2.9978810E 10	2.9991054E 10	3.0099343E 10	3.1419903E 10		
P					3.5421574E 03	3.3389011E 03
OMEGA-CP	1.8243320E 09	2.1552528E 08	7.4091726E 07	5.8003659E 07	5.6428443E 07	5.6412532E 07
OMEGA-CP/OMEGA-P	3.2335126E 01	3.8205214E 00	1.3133913E 00	1.0282052E 00	1.0002820E 00	1.0000000E 00
LAMBDA-DCP	1.0324591E 02	8.7393371E 02	2.5421842E 03	3.2472920E 03	3.3379411E 03	3.3388825E 03
DPSILON-PCP	8.7105435E 09	3.4301915E 09	3.5376194E 09	2.2315689E 09	8.9808656E 10	8.9783334E 12
DPSILON-DCP	5.2204217E 06	1.3256610E 09	1.2654043E 09	4.9257836E 08	5.0632882E 07	5.0647162E 05
DELTA	3.6142538E 05	1.0509107E 07	3.3811403E 07	3.8797056E-02	-0.	-0.
DELTA/OMEGA-CP	1.9811382E-04	4.8760436E-02	4.5635195E-01	6.6887257E-10	-0.	-0.
OMEGA-WP	1.8243320E 09	2.1552528E 08	7.4091726E 07	5.8003659E 07	5.6428443E 07	5.6412532E 07
OMEGA-WP/OMEGA-P	3.2335126E 01	3.8205214E 00	1.3133913E 00	1.0282052E 00	1.0002820E 00	1.0000000E 00
LAMBDA-DWP	1.0324591E 02	8.7393371E 02	2.5421841E 03	3.2472919E 03	3.3379410E 03	3.3388824E 03
DPSILON-PWP	8.7105435E 09	3.4301915E 09	3.5376194E 09	2.2315689E 09	8.9808656E 10	8.9783334E 12
DPSILON-DWP	5.2204217E 06	1.3256610E 09	1.2654043E 09	4.9257836E 08	5.0632882E 07	5.0647162E 05
DELTA-Q	3.6142538E 05	1.0509107E 07	3.3811403E 07	3.8797056E-02	-0.	-0.
DELTA-Q/OMEGA-WP	1.9811382E-04	4.8760436E-02	4.5635195E-01	6.6887257E-10	-0.	-0.

WITHOUT OMEGA-CP APPROXIMATELY EQUAL TO OMEGA-P

OMEGA-CP	2.7781250E 06	1.1789062E 08	7.4687500E 07	5.7337500E 07	5.6412533E 07	5.6412533E 07
OMEGA-CP/OMEGA-P	5.2791304E 00	2.0497949E 00	1.3239573E 00	1.0270324E 00	1.0000000E 00	1.0000000E 00
LAMBDA-DCP	6.3246107E 02	1.5777082E 03	2.5219055E 03	3.2510000E 03	3.3388824E 03	3.3388824E 03
DPSILON-PCP	1.4213500E 07	1.8762876E 09	3.5660655E 09	9.2210395E 09	8.9783335E 10	8.9783335E 12
DPSILON-DCP	1.2300151E 09	1.1929130E 09	1.1595671E 09	4.7102169E 08	5.0650327E 07	5.0647160E 05
DELTA	5.3000000E 06	2.0125000E 07	8.5749999E 06	9.5312489E-03	0.	0.
DELTA/OMEGA-CP	1.7786432E-02	1.7070908E-01	1.1481171E-01	1.6450915E-10	0.	0.

TABLE V. - Continued. DISPERSION AND DAMPING IN A THERMAL PLASMA

N-E= 1.0E 09
LAMBDA-I= 1.0000002E-03 E-F-0= 3.6457463E-09 T-E-0= 4.2307029E-05 OMEGA-P= 1.7839209E 09 LAMBDA-DP= 1.0558473E 02

T-E= 1.0E 01
P-E= 1.3624228E-12 LAMBDA-S= 6.9014320E-04 DELTA-Q/DELTA ARG= 6.8123071E-04 DELTA-Q/DELTA= 1.0000000E 00

LAMBDA-W	9.9999999E-04	3.0000000E-03	9.9999999E-03	3.0000000E-02	1.0000000E 00	1.0000000E 02
K	6.2831853E 03	2.0943951E 03	6.2831852E 02	2.0943951E 02	6.2831852E 00	6.2831851E-02
OMEGA-0	1.8835482E 14	6.2784937E 13	1.8835481E 13	6.2784937E 12	1.8835481E 11	1.8835481E 09
EPSILON	9.9999999E-01	9.9999999E-01	9.9999998E-01	9.9999992E-01	9.9991030E-01	1.0298905E-01
V-EMP	2.9977600E 10	2.9977600E 10	2.9977600E 10	2.9977601E 10	2.9978944E 10	9.3411713E 10
P						
OMEGA-CP	5.2099792E 10	7.3745732E 09	2.2870796E 09	1.8398274E 09	1.7839712E 09	1.7839209E 09
OMEGA-CP/OMEGA-P	2.9205214E 01	4.1339127E 00	1.2820521E 00	1.0313391E 00	1.0000282E 00	1.0000000E 00
LAMBDA-DCP	3.6152700E 00	2.5541114E 01	8.2356037E 01	1.0237635E 02	1.0558176E 02	1.0558473E 02
DPSILON-PCP	8.2919394E 06	3.5210993E 06	3.6400002E 06	8.7845286E 06	2.8392783E 08	2.8391983E 10
DPSILON-GCP	5.4837656E 05	1.2914350E 06	1.2492503E 06	5.1764542E 05	1.6015588E 04	1.6016039E 02
DELTA	1.3350577E 07	2.9139214E 08	9.5989417E 08	1.4961931E 01	-0.	-0.
DELTA/OMEGA-CP	2.5629010E-04	3.9513084E-02	4.1970300E-01	8.1322471E-09	-0.	-0.
OMEGA-DP	5.2099938E 10	7.3745749E 09	2.2870796E 09	1.8398274E 09	1.7839712E 09	1.7839209E 09
OMEGA-DP/OMEGA-P	2.9205297E 01	4.1339136E 00	1.2820521E 00	1.0313391E 00	1.0000282E 00	1.0000000E 00
LAMBDA-DDP	3.6152598E 00	2.5541107E 01	8.2356036E 01	1.0237635E 02	1.0558176E 02	1.0558473E 02
DPSILON-PDP	8.2919626E 06	3.5211092E 06	3.6400002E 06	8.7845286E 06	2.8392783E 08	2.8391983E 10
DPSILON-GDP	5.4837821E 05	1.2914356E 06	1.2492503E 06	5.1764542E 05	1.6015588E 04	1.6016039E 02
DELTA-Q	1.3350577E 07	2.9139213E 08	9.5989417E 08	1.4961931E 01	-0.	-0.
DELTA-Q/OMEGA-DP	2.5624938E-04	3.9513075E-02	4.1970300E-01	8.1322471E-09	-0.	-0.

WITHOUT OMEGA-CP APPROXIMATELY EQUAL TO OMEGA-P

OMEGA-CP	8.9999999E 09	3.8566402E 09	2.3050766E 09	1.8390625E 09	1.7839212E 09	1.7839212E 09
OMEGA-CP/OMEGA-P	5.0450667E 00	2.1618897E 00	1.2921406E 00	1.0309103E 00	1.0000001E 00	1.0000001E 00
LAMBDA-DCP	2.0928312E 01	4.8839093E 01	8.1713036E 01	1.0241893E 02	1.0558472E 02	1.0558472E 02
DPSILON-PCP	1.4323945E 06	1.8414101E 06	3.6686434E 06	8.7808764E 06	2.8391988E 08	2.8391988E 10
DPSILON-GCP	1.2303835E 06	1.2047829E 06	1.2047332E 06	4.9143198E 05	1.6016132E 04	1.6016031E 02
DELTA	1.7734375E 08	5.9843749E 08	2.3671875E 08	3.5390625E 00	0.	0.
DELTA/OMEGA-CP	1.9704861E-02	1.5517068E-01	1.0269452E-01	1.9243840E-09	0.	0.

N-E= 1.0E 09
LAMBDA-I= 1.0000002E-03 E-F-0= 3.6457463E-09 T-E-0= 4.2307029E-05 OMEGA-P= 1.7839209E 09 LAMBDA-DP= 1.0558473E 02

T-E= 1.0E 02
P-E= 1.3624228E-11 LAMBDA-S= 2.1824244E-03 DELTA-Q/DELTA ARG= 6.8123070E-05 DELTA-Q/DELTA= 1.0000000E 00

LAMBDA-W	3.0000000E-03	9.9999999E-03	3.0000000E-02	1.0000000E-01	1.0000000E 00	1.0000000E 02
K	2.0943951E 03	6.2831852E 02	2.0943951E 02	6.2831852E 01	6.2831852E 00	6.2831851E-02
OMEGA-0	6.2784937E 13	1.8835481E 13	6.2784937E 12	1.8835481E 12	1.8835481E 11	1.8835481E 09
EPSILON	9.9999999E-01	9.9999998E-01	9.9999992E-01	9.9999909E-01	9.9991030E-01	1.0298905E-01
V-EMP	2.9977600E 10	2.9977600E 10	2.9977601E 10	2.9977613E 10	2.9978944E 10	9.3411713E 10
P						
OMEGA-CP	5.7690444E 10	6.8155080E 09	2.3429861E 09	1.8342367E 09	1.7844240E 09	1.7839209E 09
OMEGA-CP/OMEGA-P	3.2339127E 01	3.8205215E 00	1.3133913E 00	1.0282052E 00	1.0002820E 00	1.0000000E 00
LAMBDA-DCP	3.2649221E 00	2.7636210E 01	8.0390921E 01	1.0268839E 02	1.0555496E 02	1.0558473E 02
DPSILON-PCP	2.7545159E 07	1.0847218E 07	1.1186935E 07	2.9192784E 07	2.8399991E 08	2.8391983E 10
DPSILON-GCP	1.6508423E 06	4.1921082E 06	4.0648053E 06	1.5576695E 06	1.6011523E 05	1.6016039E 03
DELTA	1.1429274E 07	3.3232714E 08	1.0692263E 09	1.2268706E 00	-0.	-0.
DELTA/OMEGA-CP	1.9811381E-04	4.8760435E-02	4.5635194E-01	6.6887257E-10	-0.	-0.
OMEGA-DP	5.7690445E 10	6.8155080E 09	2.3429861E 09	1.8342367E 09	1.7844240E 09	1.7839209E 09
OMEGA-DP/OMEGA-P	3.2339128E 01	3.8205215E 00	1.3133913E 00	1.0282052E 00	1.0002820E 00	1.0000000E 00
LAMBDA-DDP	3.2649221E 00	2.7636210E 01	8.0390921E 01	1.0268839E 02	1.0555496E 02	1.0558473E 02
DPSILON-PDP	2.7545159E 07	1.0847218E 07	1.1186935E 07	2.9192784E 07	2.8399991E 08	2.8391983E 10
DPSILON-GDP	1.6508423E 06	4.1921082E 06	4.0648053E 06	1.5576695E 06	1.6011523E 05	1.6016039E 03
DELTA-Q	1.1429274E 07	3.3232714E 08	1.0692263E 09	1.2268706E 00	-0.	-0.
DELTA-Q/OMEGA-DP	1.9811381E-04	4.8760435E-02	4.5635194E-01	6.6887257E-10	-0.	-0.

WITHOUT OMEGA-CP APPROXIMATELY EQUAL TO OMEGA-P

OMEGA-CP	9.4187498E 09	3.7292964E 09	2.3621080E 09	1.8312500E 09	1.7839212E 09	1.7839212E 09
OMEGA-CP/OMEGA-P	5.2798023E 00	2.0905055E 00	1.3241103E 00	1.0265309E 00	1.0000001E 00	1.0000001E 00
LAMBDA-DCP	1.9997857E 01	5.0506796E 01	7.9740134E 01	1.0285587E 02	1.0558472E 02	1.0558472E 02
DPSILON-PCP	4.4971218E 06	5.9353596E 06	1.1278235E 07	2.9145249E 07	2.8391988E 08	2.8391988E 10
DPSILON-GCP	3.8906390E 06	3.7691194E 06	3.6666391E 06	1.4916180E 06	1.6017033E 05	1.6016032E 03
DELTA	1.6750000E 08	6.3593749E 08	2.7109375E 08	3.0937498E-01	0.	0.
DELTA/OMEGA-CP	1.7783676E-02	1.7052479E-01	1.1476772E-01	1.6894137E-10	0.	0.

TABLE V. - Continued. DISPERSION AND DAMPING IN A THERMAL PLASMA

N-E= 1.0E 09
LAMBDA-I= 1.0000002E-03 E-F-0= 3.6457463E-09 T-E-0= 4.2307029E-05 OMEGA-P= 1.7839209E 09 LAMBDA-DP= 1.0558473E 02

T-E= 1.0E 03
P-E= 1.3624227E-10 LAMBDA-S= 6.9014320E-03 DELTA-Q/DELTA ARG= 6.8123071E-06 DELTA-Q/DELTA= 1.0000000E 00

LAMBDA-W	9.9999999E-03	3.0000000E-02	1.0000000E-01	3.0000000E-01	1.0000000E 00	1.0000000E 02
K	6.2831852E 02	2.0943951E 02	6.2831852E 01	2.0943951E 01	6.2831852E 00	6.2831851E-02
OMEGA-0	1.8835481E 13	6.2784937E 12	1.8835481E 12	6.2784938E 11	1.8835481E 11	1.8835481E 09
EPSILON	9.9999998E-01	9.9999992E-01	9.9999904E-01	9.9991030E-01	9.9978944E 10	1.0298905E-01
V-EMP	2.9977600E 10	2.9977601E 10	2.9977613E 10	2.9977721E 10		9.3411713E 10
P						
OMEGA-CP	5.2099792E 10	7.3745732E 09	2.2870796E 09	1.8398274E 09	1.7889524E 09	1.7839213E 09
OMEGA-CP/OMEGA-P	2.9205214E 01	4.1339127E 00	1.2820521E 00	1.0313391E 00	1.0028205E 00	1.0000003E 00
LAMBDA-DCP	3.6152700E 00	2.5541114E 01	8.2366037E 01	1.0237635E 02	1.0528777E 02	1.0558471E 02
UPSILON-PCP	8.2919395E 07	3.5210994E 07	3.6480002E 07	8.7645287E 07	2.8472062E 08	2.8351931E 10
UPSILON-GCP	5.4839657E 06	1.2914351E 07	1.2492503E 07	5.1764542E 06	1.5970993E 06	1.6016035E 04
DELTA	1.3350577E 07	2.9139214E 08	9.5989417E 08	1.4961938E 01	-0.	-0.
DELTA/OMEGA-CP	2.5625010E-04	3.9513084E-02	4.1970309E-01	8.1322508E-09	-0.	-0.
OMEGA-WP	5.2099792E 10	7.3745732E 09	2.2870796E 09	1.8398274E 09	1.7889524E 09	1.7839213E 09
OMEGA-CP/OMEGA-P	2.9205214E 01	4.1339127E 00	1.2820521E 00	1.0313391E 00	1.0028205E 00	1.0000003E 00
LAMBDA-DWP	3.6152697E 00	2.5541113E 01	8.2366036E 01	1.0237635E 02	1.0528777E 02	1.0558471E 02
UPSILON-PCP	8.2919395E 07	3.5210994E 07	3.6480002E 07	8.7645287E 07	2.8472062E 08	2.8351931E 10
UPSILON-GCP	5.4839657E 06	1.2914351E 07	1.2492503E 07	5.1764542E 06	1.5970993E 06	1.6016035E 04
DELTA-Q	1.3350577E 07	2.9139213E 08	9.5989417E 08	1.4961938E 01	-0.	-0.
DELTA-Q/OMEGA-WP	2.5625010E-04	3.9513084E-02	4.1970309E-01	8.1322508E-09	-0.	-0.

WITHOUT OMEGA-CP APPROXIMATELY EQUAL TO OMEGA-P

OMEGA-CP	8.9999999E 09	3.8966402E 09	2.3050796E 09	1.8390625E 09	1.7889220E 09	1.7839212E 09
OMEGA-CP/OMEGA-P	5.0450667E 00	2.1618897E 00	1.2921406E 00	1.0309103E 00	1.0028034E 00	1.0000001E 00
LAMBDA-DCP	2.0928312E 01	4.8839093E 01	8.1713036E 01	1.0241893E 02	1.0528956E 02	1.0558472E 02
UPSILON-PCP	1.4323945E 07	1.8414101E 07	3.6686434E 07	8.7608765E 07	2.8471578E 08	2.8391988E 10
UPSILON-GCP	1.2303835E 07	1.2047829E 07	1.2047332E 07	4.9143198E 06	1.5892267E 06	1.6016032E 04
DELTA	1.7734375E 08	5.9843749E 08	2.3671875E 08	3.5370625E 00	0.	0.
DELTA/OMEGA-CP	1.9704861E-02	1.5517068E-01	1.0269452E-01	1.9243840E-09	0.	0.

N-E= 1.0E 09
LAMBDA-I= 1.0000002E-03 E-F-0= 3.6457463E-07 T-E-0= 4.2307029E-05 OMEGA-P= 1.7839209E 09 LAMBDA-DP= 1.0558473E 02

T-E= 1.0E 04
P-E= 1.3624227E-09 LAMBDA-S= 2.1424449E-02 DELTA-Q/DELTA ARG= 6.8123071E-07 DELTA-Q/DELTA= 1.0000000E 00

LAMBDA-W	3.0000000E-02	1.0000000E-01	3.0000000E-01	1.0000000E 00	1.0000000E 02	1.0000000E 04
K	2.0943951E 02	6.2831852E 01	2.0943951E 01	6.2831852E 00	6.2831851E-02	6.2831852E-04
OMEGA-0	6.2784937E 12	1.8835481E 12	6.2784938E 11	1.8835481E 11	1.8835481E 09	1.8835481E 07
EPSILON	9.9999992E-01	9.9999904E-01	9.9999192E-01	9.9991030E-01	1.0298905E-01	
V-EMP	2.9977601E 10	2.9977613E 10	2.9977721E 10	2.9978944E 10	9.3411713E 10	
P						1.0559062E 02
OMEGA-CP	5.7690444E 10	6.8155079E 09	2.3429861E 09	1.8342367E 09	1.7839259E 09	1.7839209E 09
OMEGA-CP/OMEGA-P	3.2339127E 01	3.8205214E 00	1.3133913E 00	1.0282052E 00	1.0000028E 00	1.0000000E 00
LAMBDA-DCP	3.2649222E 00	2.7636210E 01	8.0390921E 01	1.0268839E 02	1.0558444E 02	1.0558473E 02
UPSILON-PCP	2.7545158E 08	1.0847218E 08	1.1186935E 08	2.9192784E 08	2.8392063E 10	2.8391983E 12
UPSILON-GCP	1.6508423E 07	4.1921082E 07	4.0648053E 07	1.5576696E 07	1.6015994E 05	1.6016039E 03
DELTA	1.1429274E 07	3.3232715E 08	1.0692263E 09	1.2268707E 00	-0.	-0.
DELTA/OMEGA-CP	1.9811381E-04	4.8760436E-02	4.5635194E-01	6.6887257E-10	-0.	-0.
OMEGA-WP	5.7690444E 10	6.8155079E 09	2.3429861E 09	1.8342367E 09	1.7839259E 09	1.7839209E 09
OMEGA-CP/OMEGA-P	3.2339127E 01	3.8205214E 00	1.3133913E 00	1.0282052E 00	1.0000028E 00	1.0000000E 00
LAMBDA-DWP	3.2649222E 00	2.7636210E 01	8.0390921E 01	1.0268839E 02	1.0558444E 02	1.0558473E 02
UPSILON-PCP	2.7545158E 08	1.0847218E 08	1.1186935E 08	2.9192784E 08	2.8392063E 10	2.8391983E 12
UPSILON-GCP	1.6508423E 07	4.1921082E 07	4.0648053E 07	1.5576696E 07	1.6015994E 05	1.6016039E 03
DELTA-Q	1.1429274E 07	3.3232714E 08	1.0692263E 09	1.2268706E 00	-0.	-0.
DELTA-Q/OMEGA-WP	1.9811381E-04	4.8760436E-02	4.5635194E-01	6.6887257E-10	-0.	-0.

WITHOUT OMEGA-CP APPROXIMATELY EQUAL TO OMEGA-P

OMEGA-CP	9.4187498E 09	3.7292964E 09	2.3621080E 09	1.8312500E 09	1.7839212E 09	1.7839212E 09
OMEGA-CP/OMEGA-P	5.2798023E 00	2.0905055E 00	1.3241103E 00	1.0263309E 00	1.0000001E 00	1.0000001E 00
LAMBDA-DCP	1.9997857E 01	5.0506796E 01	7.9740134E 01	1.0285587E 02	1.0558472E 02	1.0558472E 02
UPSILON-PCP	4.4971218E 07	5.9353597E 07	1.1278235E 08	2.9145249E 08	2.8391988E 10	2.8391988E 12
UPSILON-GCP	3.8906390E 07	3.7691194E 07	3.6686391E 07	1.4916180E 07	1.6016042E 05	1.6016032E 03
DELTA	1.6750000E 08	6.3593749E 08	2.7109375E 08	3.0937498E-01	0.	0.
DELTA/OMEGA-CP	1.7783676E-02	1.7052479E-01	1.1476772E-01	1.6894197E-10	0.	0.

TABLE V. - Continued. DISPERSION AND DAMPING IN A THERMAL PLASMA

N-E= 1.0E 09
LAMBDA-I= 1.0000002E-03 E-F-0= 3.6457463E-09 T-E-0= 4.2307029E-05 OMEGA-P= 1.7839209E 09 LAMBDA-DP= 1.0558473E 02

T-E= 1.0E 06
P-E= 1.3624227E-07 LAMBDA-S= 6.9014320E-02 DELTA-Q/DELTA ARG= 6.8123071E-08 DELTA-Q/DELTA= 1.0000000E 00

LAMBDA-W	1.0000000E-01	3.0000000E-01	1.0000000E 00	3.0000000E 00	1.0000000E 02	1.0000000E 04
K	6.2831852E 01	2.0943951E 01	6.2831852E 00	2.0943951E 00	6.2831851E-02	6.2831852E-04
OMEGA-0	1.8835481E 12	6.2784938E 11	1.8835481E 11	6.2784937E 10	1.8835481E 09	1.8835481E 07
EPSILON	9.9999909E-01	9.9999192E-01	9.9991030E-01	9.9919268E-01	1.0298905E-01	
V-EMP	2.9977613E 10	2.9977721E 10	2.9978944E 10	2.9989707E 10	9.3411713E 10	
P						1.0559062E 02
OMEGA-CP	5.2697792E 10	7.3745733E 09	2.2870796E 09	1.8398274E 09	1.7839712E 09	1.7839209E 09
OMEGA-CP/OMEGA-P	2.9205214E 01	4.1339127E 00	1.2820521E 00	1.0313391E 00	1.0000282E 00	1.0000000E 00
LAMBDA-DCP	3.6152609E 00	2.5541113E 01	8.2356036E 01	1.0237635E 02	1.0558176E 02	1.0558473E 02
EPSILON-PCP	8.2913395E 08	3.5210994E 08	3.6400003E 08	8.7845289E 08	2.8392783E 10	2.8391983E 12
EPSILON-DCP	5.4839658E 07	1.2914350E 08	1.2492502E 08	5.1764542E 07	1.6015588E 06	1.6016039E 04
DELTA	1.3350577E 07	2.7139213E 08	3.5989418E 08	1.4961931E 01	-0.	-0.
DELTA/OMEGA-CP	2.5625010E-04	3.9513083E-02	4.1970300E-01	8.1322471E-09	-0.	-0.
OMEGA-DP	5.2697792E 10	7.3745733E 09	2.2870796E 09	1.8398274E 09	1.7839712E 09	1.7839209E 09
OMEGA-DP/OMEGA-P	2.9205214E 01	4.1339127E 00	1.2820521E 00	1.0313391E 00	1.0000282E 00	1.0000000E 00
LAMBDA-DDP	3.6152609E 00	2.5541113E 01	8.2356036E 01	1.0237635E 02	1.0558176E 02	1.0558473E 02
EPSILON-PDP	8.2913395E 08	3.5210994E 08	3.6400003E 08	8.7845289E 08	2.8392783E 10	2.8391983E 12
EPSILON-DDP	5.4839658E 07	1.2914350E 08	1.2492502E 08	5.1764542E 07	1.6015588E 06	1.6016039E 04
DELTA-Q	1.3350577E 07	2.7139213E 08	3.5989417E 08	1.4961931E 01	-0.	-C.
DELTA-Q/OMEGA-DP	2.5625010E-04	3.9513083E-02	4.1970300E-01	8.1322471E-09	-0.	-C.

WITHOUT OMEGA-CP APPROXIMATELY EQUAL TO OMEGA-P

OMEGA-CP	8.9999999E 09	3.8566402E 09	2.3050766E 09	1.8390625E 09	1.7839212E 09	1.7839212E 09
OMEGA-CP/OMEGA-P	5.0450667E 00	2.1618897E 00	1.2921406E 00	1.0309103E 00	1.0000001E 00	1.0000001E 00
LAMBDA-DCP	2.0928312E 01	4.8839093E 01	8.1713036E 01	1.0241893E 02	1.0558472E 02	1.0558472E 02
EPSILON-PCP	1.4323945E 08	1.8414101E 08	3.6086434E 08	8.7808766E 08	2.8391988E 10	2.8391988E 12
EPSILON-DCP	1.2303835E 08	1.2047829E 08	1.2047332E 08	4.9143198E 07	1.6016132E 06	1.6016032E 04
DELTA	1.7734375E 06	5.9643749E 08	2.3671875E 08	3.5390625E 00	0.	0.
DELTA/OMEGA-CP	1.9704461E-02	1.5517068E-01	1.0269452E-01	1.9243840E-09	0.	0.

N-E= 1.0E 09
LAMBDA-I= 1.0000002E-03 E-F-0= 3.6457463E-09 T-E-0= 4.2307029E-05 OMEGA-P= 1.7839209E 09 LAMBDA-DP= 1.0558473E 02

T-E= 1.0E 06
P-E= 1.3624227E-07 LAMBDA-S= 2.1824244E-01 DELTA-Q/DELTA ARG= 6.8123071E-09 DELTA-Q/DELTA= 1.0000000E 00

LAMBDA-W	3.0000000E-01	1.0000000E 00	3.0000000E 00	1.0000000E 01	1.0000000E 02	1.0000000E 04
K	2.0943951E 01	6.2831852E 00	2.0943951E 00	6.2831852E-01	6.2831851E-02	6.2831852E-04
OMEGA-0	6.2784938E 11	1.8835481E 11	6.2784937E 10	1.8835481E 10	1.8835481E 09	1.8835481E 07
EPSILON	9.9999192E-01	9.9991030E-01	9.9919268E-01	9.9102988E-01	1.0298905E-01	
V-EMP	2.9977721E 10	2.9978944E 10	2.9989707E 10	3.0112962E 10	9.3411713E 10	
P						1.0559062E 02
OMEGA-CP	5.7690442E 10	6.8155079E 09	2.3429861E 09	1.8342367E 09	1.7844240E 09	1.7839209E 09
OMEGA-CP/OMEGA-P	3.2339126E 01	3.8205214E 00	1.3133913E 00	1.0282052E 00	1.0002820E 00	1.0000000E 00
LAMBDA-DCP	3.2649223E 00	2.7636210E 01	8.0390922E 01	1.0268839E 02	1.0555496E 02	1.0558473E 02
EPSILON-PCP	2.7545157E 09	1.0847218E 09	1.1186934E 09	2.9192784E 09	2.8399991E 10	2.8391983E 12
EPSILON-DCP	1.6508423E 08	4.1921082E 08	4.0648053E 08	1.5576695E 08	1.6011523E 07	1.6016039E 05
DELTA	1.1429274E 07	3.3232715E 08	1.0692262E 09	1.2268698E 00	-0.	-C.
DELTA/OMEGA-CP	1.9811382E-04	4.8760436E-02	4.5635193E-01	6.6887211E-10	-0.	-C.
OMEGA-DP	5.7690442E 10	6.8155079E 09	2.3429861E 09	1.8342367E 09	1.7844240E 09	1.7839209E 09
OMEGA-DP/OMEGA-P	3.2339126E 01	3.8205214E 00	1.3133913E 00	1.0282052E 00	1.0002820E 00	1.0000000E 00
LAMBDA-DDP	3.2649223E 00	2.7636210E 01	8.0390921E 01	1.0268839E 02	1.0555496E 02	1.0558473E 02
EPSILON-PDP	2.7545157E 09	1.0847218E 09	1.1186934E 09	2.9192784E 09	2.8399991E 10	2.8391983E 12
EPSILON-DDP	1.6508423E 08	4.1921082E 08	4.0648053E 08	1.5576695E 08	1.6011523E 07	1.6016039E 05
DELTA-Q	1.1429274E 07	3.3232714E 08	1.0692262E 09	1.2268698E 00	-0.	-C.
DELTA-Q/OMEGA-DP	1.9811382E-04	4.8760436E-02	4.5635193E-01	6.6887211E-10	-0.	-C.

WITHOUT OMEGA-CP APPROXIMATELY EQUAL TO OMEGA-P

OMEGA-CP	9.4187498E 09	3.7292964E 09	2.3621080E 09	1.8312500E 09	1.7839212E 09	1.7839212E 09
OMEGA-CP/OMEGA-P	5.2798023E 00	2.0905055E 00	1.3241103E 00	1.0265309E 00	1.0000001E 00	1.0000001E 00
LAMBDA-DCP	1.9997857E 01	5.0506796E 01	7.9740134E 01	1.0285587E 02	1.0558472E 02	1.0558472E 02
EPSILON-PCP	4.4371218E 08	5.9353577E 08	1.1278235E 09	2.9145249E 09	2.8391988E 10	2.8391988E 12
EPSILON-DCP	8.8063890E 08	3.7691174E 08	4.6666391E 08	1.4916180E 08	1.6017033E 07	1.6016031E 05
DELTA	1.6750000E 08	6.3593749E 08	2.7109375E 08	3.0937498E-01	0.	0.
DELTA/OMEGA-CP	1.7783676E-02	1.7052479E-01	1.1476772E-01	1.6894197E-10	0.	0.

TABLE V. - Continued. DISPERSION AND DAMPING IN A THERMAL PLASMA

N-C= 1.0E 09
LAMBDA-I= 1.0000002E-03 E-F-0= 3.6457463E-09 T-E-0= 4.2307029E-05 OMEGA-P= 1.7839209E 09 LAMBDA-OP= 1.0558473E 02

T-E= 1.0E 07
P-E= 1.3624228E-06 LAMBDA-S= 6.7014319E-01 DELTA-Q/DELTA ARG= 6.8123071E-10 DELTA-Q/DELTA= 1.0000000E 00

LAMBDA-W	1.0000000E 00	3.0000000E 00	1.0000000E 01	3.0000000E 01	1.0000000E 02	1.0000000E 04
K	6.2831852E 00	2.0943951E 00	6.2831852E-01	2.0943950E-01	6.2831851E-02	6.2831852E-04
OMEGA-C	1.8835481E 11	6.2784938E 10	1.8835481E 10	6.2784938E 09	1.8835481E 09	1.8835481E 07
EPSILON	9.9991030E-01	9.9919268E-01	9.9102986E-01	9.1926900E-01	1.0298905E-01	
V-EMP	2.9978944E 10	2.9989707E 10	3.0112962E 10	3.1266232E 10	9.3411713E 10	
P						1.0559062E 02
OMEGA-CP	5.2099789E 10	7.3745729E 09	2.2870795E 09	1.8398274E 09	1.7889524E 09	1.7839213E 09
OMEGA-CP/OMEGA-P	2.9205213E 01	4.1339126E 00	1.2820521E 00	1.0313391E 00	1.0028205E 00	1.0000003E 00
LAMBDA-OCP	3.6152701E 00	2.5541115E 01	8.2356039E 01	1.0237635E 02	1.0528777E 02	1.0558471E 02
UPSILON-PCP	8.2919390E 09	3.5210992E 09	3.6400002E 09	8.7845289E 09	2.8472063E 10	2.8391990E 12
UPSILON-OCP	5.4839658E 08	1.2914350E 09	1.2492502E 09	5.1764541E 08	1.5970992E 08	1.6016035E 06
DELTA	1.3350578E 07	2.9139215E 08	9.5989412E 08	1.4961918E 01	-0.	-0.
DELTA/OMEGA-CP	2.5625014E-04	3.9513087E-02	4.1970298E-01	8.1322398E-09	-0.	-0.
OMEGA-QP	5.2099789E 10	7.3745729E 09	2.2870795E 09	1.8398274E 09	1.7889524E 09	1.7839213E 09
OMEGA-QP/OMEGA-P	2.9205213E 01	4.1339126E 00	1.2820521E 00	1.0313391E 00	1.0028205E 00	1.0000003E 00
LAMBDA-OCP	3.6152701E 00	2.5541114E 01	8.2356038E 01	1.0237635E 02	1.0528777E 02	1.0558471E 02
UPSILON-PCP	8.2919390E 09	3.5210992E 09	3.6400002E 09	8.7845289E 09	2.8472063E 10	2.8391990E 12
UPSILON-OCP	5.4839658E 08	1.2914350E 09	1.2492502E 09	5.1764541E 08	1.5970992E 08	1.6016035E 06
DELTA-Q	1.3350578E 07	2.9139214E 08	9.5989411E 08	1.4961918E 01	-0.	-0.
DELTA-Q/OMEGA-QP	2.5625014E-04	3.9513087E-02	4.1970298E-01	8.1322398E-09	-0.	-0.

WITHOUT OMEGA-CP APPROXIMATELY EQUAL TO OMEGA-P

OMEGA-CP	8.9999999E 09	3.8566462E 09	2.3050766E 09	1.8390625E 09	1.7889220E 09	1.7839212E 09
OMEGA-CP/OMEGA-P	5.0450667E 00	2.1618897E 00	1.2921406E 00	1.0309103E 00	1.0028034E 00	1.0000001E 00
LAMBDA-OCP	2.0428312E 01	4.8839093E 01	8.1713036E 01	1.0241893E 02	1.0528956E 02	1.0558472E 02
UPSILON-PCP	1.4323945E 09	1.8414101E 09	3.6686434E 09	8.7808766E 09	2.8471578E 10	2.8391988E 12
UPSILON-OCP	1.2303834E 09	1.2047828E 09	1.2047332E 09	4.9143198E 08	1.5892266E 08	1.6016032E 06
DELTA	1.7734375E 08	5.9843749E 08	2.3671875E 08	3.5390625E 00	0.	0.
DELTA/OMEGA-CP	1.9704861E-02	1.5517068E-01	1.0269452E-01	1.9243840E-09	0.	0.

N-E=10.0E 11
LAMBDA-I= 1.0000002E-04 E-F-0= 3.6457461E-07 T-E-0= 4.2307028E-03 OMEGA-P= 5.6412531E 10 LAMBDA-OP= 3.3388825E 00

T-E= 1.0E 01
P-E= 1.3624228E-09 LAMBDA-S= 2.1824244E-05 DELTA-Q/DELTA ARG= 2.1542406E-02 DELTA-Q/DELTA= 1.0000770E 00

LAMBDA-W	3.0000000E-05	9.9999999E-05	3.0000000E-04	9.9999999E-04	9.9999999E-03	1.0000000E 00
K	2.0943951E 05	6.2831852E 04	2.0943951E 04	6.2831853E 03	6.2831852E 02	6.2831852E 00
OMEGA-C	6.2784938E 15	1.8835481E 15	6.2784938E 14	1.8835482E 14	1.8835481E 13	1.8835481E 11
EPSILON	9.9999999E-01	9.9999999E-01	9.9999998E-01	9.9999989E-01	9.9999102E-01	9.1029890E-01
V-EMP	2.9977600E 10	2.9977600E 10	2.9977600E 10	2.9977601E 10	2.9977734E 10	3.1419903E 10
P						
OMEGA-CP	1.8243320E 12	2.1552528E 11	7.4091724E 10	5.8003657E 10	5.6428442E 10	5.6412532E 10
OMEGA-CP/OMEGA-P	3.2331126E 01	3.8205214E 00	1.3133913E 00	1.0282052E 00	1.0002820E 00	1.0000000E 00
LAMBDA-OCP	1.0324591E-01	8.7393371E-01	2.5421842E 00	3.2472920E 00	3.3379410E 00	3.3388824E 00
UPSILON-PCP	8.7105435E 06	3.4301914E 06	3.5376193E 06	9.2315688E 06	8.9808656E 07	8.9783334E 09
UPSILON-OCP	5.2204215E 05	1.3256610E 06	1.2854043E 06	4.9257835E 05	5.0632881E 04	5.0647161E 02
DELTA	3.6142538E 08	1.0509107E 10	3.3611962E 10	3.8797056E 01	-0.	-0.
DELTA/OMEGA-CP	1.9811382E-04	4.8760436E-02	4.5635193E-01	6.6887257E-10	-0.	-0.
OMEGA-QP	1.8300457E 12	2.1557156E 11	7.4092296E 10	5.8003662E 10	5.6428442E 10	5.6412532E 10
OMEGA-QP/OMEGA-P	3.2440412E 01	3.8213418E 00	1.3134014E 00	1.0282053E 00	1.0002820E 00	1.0000000E 00
LAMBDA-OCP	1.0292355E-01	8.7374609E-01	2.5421646E 00	3.2472917E 00	3.3379410E 00	3.3388824E 00
UPSILON-PCP	8.7378248E 06	3.4309280E 06	3.5376466E 06	9.2315694E 06	8.9808656E 07	8.9783334E 09
UPSILON-OCP	5.2377611E 05	1.3261474E 06	1.2854774E 06	4.9258118E 05	5.0632883E 04	5.0647161E 02
DELTA-Q	3.6145321E 08	1.0509416E 10	3.3614565E 10	3.8800042E 01	-0.	-0.
DELTA-Q/OMEGA-QP	1.9751048E-04	4.8753721E-02	4.5638354E-01	6.6892402E-10	-0.	-0.

WITHOUT OMEGA-CP APPROXIMATELY EQUAL TO OMEGA-P

OMEGA-CP	2.9781246E 11	1.1793747E 11	7.4687465E 10	5.7937498E 10	5.6412539E 10	5.6412532E 10
OMEGA-CP/OMEGA-P	5.2791898E 00	2.0906253E 00	1.3239516E 00	1.0270324E 00	1.0000001E 00	1.0000000E 00
LAMBDA-OCP	6.3246115E-01	1.5470736E 00	2.5217066E 00	3.2510001E 00	3.3388820E 00	3.3388824E 00
UPSILON-PCP	1.4219499E 06	1.8770331E 06	3.5660638E 06	9.2210392E 06	8.9783345E 07	8.9783334E 09
UPSILON-OCP	1.2306153E 06	1.1917081E 06	1.1596905E 06	4.7102110E 05	5.0650308E 04	5.0647161E 02
DELTA	5.2968747E 09	2.0124999E 10	8.5781246E 09	9.5312500E 00	0.	0.
DELTA/OMEGA-CP	1.7785940E-02	1.7064127E-01	1.1485360E-01	1.6450917E-10	0.	0.

TABLE V. - Continued. DISPERSION AND DAMPING IN A THERMAL PLASMA

N-E=10.0E 11
LAMBDA-I= 1.0000002E-04 E-F-0= 3.6457461E-07 T-E-0= 4.2307028E-03 OMEGA-P= 5.6412531E 10 LAMBDA-OP= 3.3388825E 00

T-E= 1.0E 02
P-E= 1.3624228E-08 LAMBDA-S= 6.9014319E-05 DELTA-Q/DELTA ARG= 2.1542406E-03 DELTA-Q/DELTA= 1.0000000E 00

LAMBDA-W	9.9999999E-05	3.0000000E-04	9.9999999E-04	3.0000000E-03	9.9999999E-03	1.0000000E 00
K	6.2831852E 04	2.0943951E 04	6.2831853E 03	2.0943951E 03	6.2831852E 02	6.2831852E 00
OMEGA-Q	1.8835481E 15	6.2784938E 14	1.8835482E 14	6.2784937E 13	1.8835481E 13	1.8835481E 11
EPSILON	9.9999999E-01	9.9999998E-01	9.9999989E-01	9.9999918E-01	9.9999102E-01	9.1029890E-01
V-EMP	2.9977600E 10	2.9977600E 10	2.9977601E 10	2.9977612E 10	2.9977734E 10	3.1419903E 10
P						
OMEGA-CP	1.6475400E 12	2.3320447E 11	7.2323807E 10	5.8180450E 10	5.6571643E 10	5.6412546E 10
OMEGA-CP/OMEGA-P	2.9205214E 01	4.1339126E 00	1.2820521E 00	1.0313391E 00	1.0028205E 00	1.0000003E 00
LAMBDA-OCP	1.1432488E-01	8.0768094E-01	2.6043266E 00	3.2374245E 00	3.3294916E 00	3.3388816E 00
UPSILON-PCP	2.6221415E 07	1.1134694E 07	1.1510691E 07	2.7779119E 07	9.0036566E 07	8.9783355E 09
UPSILON-GCP	1.7341822E 06	4.0838762E 06	3.9504761E 06	1.6369385E 06	5.0504714E 05	5.0647150E 03
DELTA	4.2218233E 08	9.2146285E 09	3.0354519E 10	4.7313781E 02	-0.	-0.
DELTA/OMEGA-CP	2.5625012E-04	3.9513085E-02	4.1970301E-01	8.1322471E-09	-0.	-0.
OMEGA-QP	1.6475863E 12	2.3320504E 11	7.2323810E 10	5.8180450E 10	5.6571643E 10	5.6412546E 10
OMEGA-QP/OMEGA-P	2.9206034E 01	4.1339227E 00	1.2820522E 00	1.0313391E 00	1.0028205E 00	1.0000003E 00
LAMBDA-OQP	1.1432166E-01	8.0767897E-01	2.6043264E 00	3.2374244E 00	3.3294916E 00	3.3388816E 00
UPSILON-PQP	2.6222151E 07	1.1134721E 07	1.1510692E 07	2.7779119E 07	9.0036566E 07	8.9783355E 09
UPSILON-GQP	1.7342344E 06	4.0838926E 06	3.9504781E 06	1.6369386E 06	5.0504714E 05	5.0647150E 03
DELTA-Q	4.2218233E 08	9.2146281E 09	3.0354519E 10	4.7313780E 02	-0.	-0.
DELTA-Q/OMEGA-QP	2.5624292E-04	3.9512989E-02	4.1970298E-01	8.1322471E-09	-0.	-0.

WITHOUT OMEGA-CP APPROXIMATELY EQUAL TO OMEGA-P

OMEGA-CP	2.8458981E 11	1.2200191E 11	7.2874950E 10	5.8124999E 10	5.6522538E 10	5.6412532E 10
OMEGA-CP/OMEGA-P	5.0447977E 00	2.1626739E 00	1.2918220E 00	1.0303561E 00	1.0019500E 00	1.0000000E 00
LAMBDA-OCP	6.6184664E-01	1.5438677E 00	2.5846304E 00	3.2405130E 00	3.3323842E 00	3.3388824E 00
UPSILON-PCP	4.5293875E 06	8.8251624E 06	1.1598409E 07	2.7752643E 07	8.9958414E 07	8.9783334E 09
UPSILON-GCP	3.8512317E 06	3.8065839E 06	3.8109815E 06	1.5564711E 06	5.0383856E 05	5.0647165E 03
DELTA	5.6093748E 09	1.8906249E 10	7.4921872E 09	1.1500000E 02	0.	0.
DELTA/OMEGA-CP	1.9710385E-02	1.5496682E-01	1.0280881E-01	1.9784946E-09	0.	0.

N-E=10.0E 11
LAMBDA-I= 1.0000002E-04 E-F-0= 3.6457461E-07 T-E-0= 4.2307028E-03 OMEGA-P= 5.6412531E 10 LAMBDA-OP= 3.3388825E 00

T-E= 1.0E 03
P-E= 1.3624227E-07 LAMBDA-S= 2.1824244E-04 DELTA-Q/DELTA ARG= 2.1542406E-04 DELTA-Q/DELTA= 1.0000000E 00

LAMBDA-W	3.0000000E-04	9.9999999E-04	3.0000000E-03	9.9999999E-03	1.0000000E 00	1.0000000E 02
K	2.0943951E 04	6.2831853E 03	2.0943951E 03	6.2831852E 02	6.2831852E 00	6.2831851E-02
OMEGA-Q	6.2784938E 14	1.8835482E 14	6.2784937E 13	1.8835481E 13	1.8835481E 11	1.8835481E 09
EPSILON	9.9999998E-01	9.9999989E-01	9.9999918E-01	9.9999102E-01	9.1029890E-01	
V-EMP	2.9977600E 10	2.9977601E 10	2.9977612E 10	2.9977734E 10	3.1419903E 10	
P						3.3407451E 00
OMEGA-CP	1.8243319E 12	2.1552528E 11	7.4091724E 10	5.8003657E 10	5.6412690E 10	5.6412531E 10
OMEGA-CP/OMEGA-P	3.2339125E 01	3.8205214E 00	1.3133913E 00	1.0282052E 00	1.0000028E 00	1.0000000E 00
LAMBDA-OCP	1.0324591E-01	8.7393371E-01	2.5421842E 00	3.2472920E 00	3.3388731E 00	3.3388825E 00
UPSILON-PCP	8.7105433E 07	3.4301914E 07	3.5376193E 07	9.2315688E 07	8.9783585E 09	8.9783334E 11
UPSILON-GCP	5.2204218E 06	1.3256610E 07	1.2854043E 07	4.9257835E 06	5.0647019E 04	5.0647161E 02
DELTA	3.6142541E 08	1.0509107E 10	3.3811902E 10	3.8797056E 01	-0.	-0.
DELTA/OMEGA-CP	1.9811384E-04	4.8760436E-02	4.5635193E-01	6.6887257E-10	-0.	-0.
OMEGA-QP	1.8243325E 12	2.1552528E 11	7.4091724E 10	5.8003657E 10	5.6412690E 10	5.6412531E 10
OMEGA-QP/OMEGA-P	3.2339135E 01	3.8205215E 00	1.3133913E 00	1.0282052E 00	1.0000028E 00	1.0000000E 00
LAMBDA-OQP	1.0324588E-01	8.7393370E-01	2.5421842E 00	3.2472920E 00	3.3388731E 00	3.3388824E 00
UPSILON-PQP	8.7105460E 07	3.4301915E 07	3.5376193E 07	9.2315688E 07	8.9783585E 09	8.9783334E 11
UPSILON-GQP	5.2204235E 06	1.3256611E 07	1.2854043E 07	4.9257835E 06	5.0647019E 04	5.0647161E 02
DELTA-Q	3.6142541E 08	1.0509107E 10	3.3811902E 10	3.8797056E 01	-0.	-0.
DELTA-Q/OMEGA-QP	1.9811378E-04	4.8760435E-02	4.5635193E-01	6.6887257E-10	-0.	-0.

WITHOUT OMEGA-CP APPROXIMATELY EQUAL TO OMEGA-P

OMEGA-CP	2.9781247E 11	1.1793747E 11	7.4687465E 10	5.7937498E 10	5.6412539E 10	5.6412532E 10
OMEGA-CP/OMEGA-P	5.2791899E 00	2.0906253E 00	1.3239516E 00	1.0270324E 00	1.0000001E 00	1.0000000E 00
LAMBDA-OCP	6.3246113E-01	1.5370736E 00	2.5219066E 00	3.2510001E 00	3.3388820E 00	3.3388824E 00
UPSILON-PCP	1.4213498E 07	1.8770331E 07	3.5660638E 07	9.2210393E 07	8.9783345E 09	8.9783335E 11
UPSILON-GCP	1.2305152E 07	1.1917081E 07	1.1596765E 07	4.7102112E 06	5.0647173E 04	5.0647160E 02
DELTA	5.2968747E 09	2.0124999E 10	8.5781246E 09	9.5312500E 00	0.	0.
DELTA/OMEGA-CP	1.7735940E-02	1.7064127E-01	1.1485360E-01	1.6450917E-10	0.	0.

TABLE V. - Continued. DISPERSION AND DAMPING IN A THERMAL PLASMA

N-E=10.0E 11
LAMBDA-I= 1.0000002E-04 E-F-O= 3.6457461E-07 T-E-O= 4.2307028E-03 OMEGA-P= 5.6412531E 10 LAMBDA-OP= 3.3388825E 00

T-E= 1.0E 04
P-E= 1.3624228E-06 LAMBDA-S= 6.4014320E-04 DELTA-Q/DELTA ARG= 2.1542406E-05 DELTA-Q/DELTA= 1.0000000E 00

LAMBDA-W	9.9999999E-04	3.0000000E-03	9.9999999E-03	3.0000000E-02	1.0000000E 00	1.0000000E 02
K	6.2831853E 03	2.0943951E 03	6.2831852E 02	2.0943951E 02	6.2831852E 00	6.2831851E-02
OMEGA-O	1.8835482E 14	6.2784937E 13	1.8835481E 13	6.2784937E 12	1.8835481E 11	1.8835481E 09
EPSILON	9.9999989E-01	9.9999918E-01	9.9999102E-01	9.9991926E-01	9.1029890E-01	
V-EMP	2.9977601E 10	2.9977612E 10	2.9977734E 10	2.9978810E 10	3.1419903E 10	
P						3.3407451E 00
OMEGA-CP	1.6475401E 12	2.3320448E 11	7.2323807E 10	5.8180450E 10	5.6414121E 10	5.6412531E 10
OMEGA-CP/OMEGA-P	2.9205214E 01	4.1339127E 00	1.2820521E 00	1.0313391E 00	1.0000282E 00	1.0000000E 00
LAMBDA-OCP	1.1432487E-01	8.0768094E-01	2.6043266E 00	3.2374245E 00	3.3387884E 00	3.3388825E 00
UPSILON-PCP	2.6221415E 08	1.1134674E 08	1.1510691E 08	2.7779119E 08	8.9785863E 09	8.9783334E 11
UPSILON-OCP	1.7341823E 07	4.0838763E 07	3.9504761E 07	1.6369386E 07	5.0645736E 05	5.0647163E 03
DELTA	4.2216232E 08	9.2146283E 09	3.0354519E 10	4.7313781E 02	-0.	-0.
DELTA/OMEGA-CP	2.5625010E-04	3.9513084E-02	4.1970300E-01	8.1322471E-09	-0.	-0.
OMEGA-QP	1.6475401E 12	2.3320448E 11	7.2323807E 10	5.8180450E 10	5.6414121E 10	5.6412531E 10
OMEGA-QP/OMEGA-P	2.9205214E 01	4.1339127E 00	1.2820521E 00	1.0313391E 00	1.0000282E 00	1.0000000E 00
LAMBDA-OCP	1.1432487E-01	8.0768093E-01	2.6043266E 00	3.2374244E 00	3.3387883E 00	3.3388824E 00
UPSILON-PCP	2.6221415E 08	1.1134674E 08	1.1510691E 08	2.7779119E 08	8.9785863E 09	8.9783334E 11
UPSILON-OCP	1.7341823E 07	4.0838763E 07	3.9504761E 07	1.6369386E 07	5.0645736E 05	5.0647163E 03
DELTA-Q	4.2216232E 08	9.2146261E 09	3.0354519E 10	4.7313780E 02	-0.	-0.
DELTA-Q/OMEGA-QP	2.5625010E-04	3.9513084E-02	4.1970300E-01	8.1322471E-09	-0.	-0.

WITHOUT OMEGA-CP APPROXIMATELY EQUAL TO OMEGA-P

OMEGA-CP	2.8458981E 11	1.2200191E 11	7.2674957E 10	5.8124999E 10	5.6412539E 10	5.6412532E 10
OMEGA-CP/OMEGA-P	5.0447977E 00	2.1626739E 00	1.2918221E 00	1.0303561E 00	1.0000001E 00	1.0000000E 00
LAMBDA-OCP	6.6184664E-01	1.5438677E 00	2.5846302E 00	3.2405130E 00	3.3388820E 00	3.3388824E 00
UPSILON-PCP	4.5293875E 07	5.8251624E 07	1.1578410E 08	2.7752643E 08	8.9783345E 09	8.9783335E 11
UPSILON-OCP	3.8912317E 07	3.8065839E 07	3.8109815E 07	1.5564710E 07	5.0647460E 05	5.0647160E 03
DELTA	5.6037748E 09	1.8906249E 10	7.4921872E 09	1.1500000E 02	0.	0.
DELTA/OMEGA-CP	1.9710385E-02	1.5496682E-01	1.0280880E-01	1.9784746E-09	0.	0.

N-E=10.0E 11
LAMBDA-I= 1.0000002E-04 E-F-O= 3.6457461E-07 T-E-O= 4.2307028E-03 OMEGA-P= 5.6412531E 10 LAMBDA-OP= 3.3388825E 00

T-E= 1.0E 05
P-E= 1.3624228E-05 LAMBDA-S= 2.1824244E-03 DELTA-Q/DELTA ARG= 2.1542406E-06 DELTA-Q/DELTA= 1.0000000E 00

LAMBDA-W	3.0000000E-03	9.9999999E-03	3.0000000E-02	1.0000000E-01	1.0000000E 00	1.0000000E 02
K	2.0943951E 03	6.2831852E 02	2.0943951E 02	6.2831852E 01	6.2831852E 00	6.2831851E-02
OMEGA-O	6.2784937E 13	1.8835481E 13	6.2784937E 12	1.8835481E 12	1.8835481E 11	1.8835481E 09
EPSILON	9.9999918E-01	9.9991102E-01	9.9991926E-01	9.9910299E-01	9.1029890E-01	
V-EMP	2.9977612E 10	2.9977734E 10	2.9978810E 10	2.9991054E 10	3.1419903E 10	
P						3.3407451E 00
OMEGA-CP	1.8243320E 12	2.1552528E 11	7.4091725E 10	5.8003657E 10	5.6428442E 10	5.6412532E 10
OMEGA-CP/OMEGA-P	3.2339127E 01	3.8205215E 00	1.3133913E 00	1.0282052E 00	1.0002820E 00	1.0000000E 00
LAMBDA-OCP	1.0324591E-01	8.7393370E-01	2.5421842E 00	3.2472920E 00	3.3379410E 00	3.3388824E 00
UPSILON-PCP	8.7105439E 06	3.4301915E 08	3.5376193E 08	9.2315689E 08	8.9808656E 09	8.9783335E 11
UPSILON-OCP	5.2204216E 07	1.3256610E 08	1.2854043E 08	4.9257836E 07	5.0632882E 06	5.0647162E 04
DELTA	3.6142537E 08	1.0509107E 10	3.3811903E 10	3.8797056E 01	-0.	-0.
DELTA/OMEGA-CP	1.9811381E-04	4.8760435E-02	4.5635194E-01	6.6887257E-10	-0.	-0.
OMEGA-QP	1.8243320E 12	2.1552528E 11	7.4091725E 10	5.8003657E 10	5.6428442E 10	5.6412532E 10
OMEGA-QP/OMEGA-P	3.2339127E 01	3.8205215E 00	1.3133913E 00	1.0282052E 00	1.0002820E 00	1.0000000E 00
LAMBDA-OCP	1.0324591E-01	8.7393370E-01	2.5421842E 00	3.2472920E 00	3.3379410E 00	3.3388824E 00
UPSILON-PCP	8.7105439E 06	3.4301915E 08	3.5376193E 08	9.2315689E 08	8.9808656E 09	8.9783335E 11
UPSILON-OCP	5.2204216E 07	1.3256610E 08	1.2854043E 08	4.9257836E 07	5.0632882E 06	5.0647162E 04
DELTA-Q	3.6142537E 08	1.0509107E 10	3.3811903E 10	3.8797056E 01	-0.	-0.
DELTA-Q/OMEGA-QP	1.9811381E-04	4.8760435E-02	4.5635194E-01	6.6887257E-10	-0.	-0.

WITHOUT OMEGA-CP APPROXIMATELY EQUAL TO OMEGA-P

OMEGA-CP	2.9781247E 11	1.1789061E 11	7.4687465E 10	5.7937498E 10	5.6412539E 10	5.6412532E 10
OMEGA-CP/OMEGA-P	5.2791899E 00	2.0897947E 00	1.3239516E 00	1.0270324E 00	1.0000001E 00	1.0000000E 00
LAMBDA-OCP	6.3246113E-01	1.5977084E 00	2.5210066E 00	3.2510001E 00	3.3388820E 00	3.3388824E 00
UPSILON-PCP	1.4219438E 06	1.8762873E 08	3.5660638E 08	9.2210393E 08	8.9783345E 09	8.9783335E 11
UPSILON-OCP	1.2306153E 08	1.1929135E 08	1.1996905E 08	4.7102112E 07	5.0650309E 06	5.0647162E 04
DELTA	9.2569747E 09	2.0124993E 10	8.5781246E 09	9.5312500E 00	0.	0.
DELTA/OMEGA-CP	1.7785940E-02	1.7579909E-01	1.1485360E-01	1.6450917E-10	0.	0.

TABLE V. - Continued. DISPERSION AND DAMPING IN A THERMAL PLASMA

N-E=10.0E 11
LAMBDA-I= 1.0000002E-04 E-F-0= 3.6457461E-07 T-E-0= 4.2307028E-03 OMEGA-P= 5.6412531E 10 LAMBDA-OP= 3.3388825E 00

T-E= 1.0E 06
P-E= 1.3624228E-04 LAMBDA-S= 6.9014319E-03 DELTA-Q/DELTA ARG= 2.1542406E-07 DELTA-Q/DELTA= 1.0000000E 00

LAMBDA-W	9.9999999E-03	3.0000000E-02	1.0000000E-01	3.0000000E-01	1.0000000E 00	1.0000000E 02
K	6.2831852E 02	2.0943951E 02	6.2831852E 01	2.0943951E 01	6.2831852E 00	6.2831851E-02
OMEGA-0	1.8835481E 13	6.2784937E 12	1.8835481E 12	6.2784938E 11	1.8835481E 11	1.8835481E 09
EPSILON	9.9999102E-01	9.9991926E-01	9.9910299E-01	9.9192690E-01	9.1029890E-01	
V-EMP	2.9977734E 10	2.9978810E 10	2.9991054E 10	3.0099343E 10	3.1419903E 10	
P						3.3407451E 00
OMEGA-CP	1.6475400E 12	2.3320448E 11	7.2323806E 10	5.8180450E 10	5.6571643E 10	5.6412546E 10
OMEGA-CP/OMEGA-P	2.9205214E 01	4.1339127E 00	1.2820521E 00	1.0313391E 00	1.0028205E 00	1.0000003E 00
LAMBDA-OCP	1.1432488E-01	8.0768094E-01	2.6043266E 00	3.2374245E 00	3.3294916E 00	3.3388816E 00
UPSILON-PCP	2.6221414E 09	1.1134694E 09	1.1510691E 09	2.7779119E 09	9.0036566E 09	8.9783357E 11
UPSILON-GCP	1.7341822E 08	4.0838763E 08	3.9504761E 08	1.6369386E 08	5.0504714E 07	5.0647148E 05
DELTA	4.2218233E 08	9.2146283E 09	3.0354519E 10	4.7313781E 02	-0.	-0.
DELTA/OMEGA-CP	2.5625012E-04	3.9513084E-02	4.1970300E-01	8.1322471E-09	-0.	-0.
OMEGA-QP	1.6475400E 12	2.3320448E 11	7.2323806E 10	5.8180450E 10	5.6571643E 10	5.6412546E 10
OMEGA-QP/OMEGA-P	2.9205214E 01	4.1339127E 00	1.2820521E 00	1.0313391E 00	1.0028205E 00	1.0000003E 00
LAMBDA-OQP	1.1432488E-01	8.0768093E-01	2.6043266E 00	3.2374244E 00	3.3294916E 00	3.3388816E 00
UPSILON-PQP	2.6221414E 09	1.1134694E 09	1.1510691E 09	2.7779119E 09	9.0036566E 09	8.9783357E 11
UPSILON-GQP	1.7341822E 08	4.0838763E 08	3.9504761E 08	1.6369386E 08	5.0504714E 07	5.0647148E 05
DELTA-Q	4.2218233E 08	9.2146281E 09	3.0354518E 10	4.7313780E 02	-0.	-0.
DELTA-Q/OMEGA-QP	2.5625012E-04	3.9513084E-02	4.1970300E-01	8.1322471E-09	-0.	-0.

WITHOUT OMEGA-CP APPROXIMATELY EQUAL TO OMEGA-P

OMEGA-CP	2.8458981E 11	1.2200191E 11	7.2874957E 10	5.8124999E 10	5.6522538E 10	5.6412532E 10
OMEGA-CP/OMEGA-P	5.0447977E 00	2.1626739E 00	1.2918221E 00	1.0303561E 00	1.0019500E 00	1.0000000E 00
LAMBDA-OCP	6.6184664E-01	1.5438677E 00	2.5846302E 00	3.2405130E 00	3.3323842E 00	3.3388824E 00
UPSILON-PCP	4.5293875E 08	5.8251623E 08	1.1598410E 09	2.7752643E 09	8.9958414E 09	8.9783335E 11
UPSILON-GCP	3.8912317E 08	3.8065837E 08	3.8109815E 08	1.5564710E 08	5.0383855E 07	5.0647164E 05
DELTA	5.6093748E 09	1.8306249E 10	7.4921872E 09	1.1500000E 02	0.	0.
DELTA/OMEGA-CP	1.9710385E-02	1.9496682E-01	1.0280880E-01	1.9784946E-09	0.	0.

N-E=10.0E 11
LAMBDA-I= 1.0000002E-04 E-F-0= 3.6457461E-07 T-E-0= 4.2307028E-03 OMEGA-P= 5.6412531E 10 LAMBDA-OP= 3.3388825E 00

T-E= 1.0E 07
P-E= 1.3624228E-03 LAMBDA-S= 2.1824244E-02 DELTA-Q/DELTA ARG= 2.1542406E-08 DELTA-Q/DELTA= 1.0000000E 00

LAMBDA-W	3.0000000E-02	1.0000000E-01	3.0000000E-01	1.0000000E 00	1.0000000E 02	1.0000000E 04
K	2.0943951E 02	6.2831852E 01	2.0943951E 01	6.2831852E 00	6.2831851E-02	6.2831852E-04
OMEGA-0	6.2784937E 12	1.8835481E 12	6.2784938E 11	1.8835481E 11	1.8835481E 09	1.8835481E 07
EPSILON	9.9991926E-01	9.9910299E-01	9.9192690E-01	9.1029890E-01		
V-EMP	2.9978810E 10	2.9991054E 10	3.0099343E 10	3.1419903E 10		
P					3.3407451E 00	3.3388826E 00
OMEGA-CP	1.8243320E 12	2.1552528E 11	7.4091725E 10	5.8003657E 10	5.6412690E 10	5.6412531E 10
OMEGA-CP/OMEGA-P	3.2339126E 01	3.8205213E 00	1.3133913E 00	1.0282052E 00	1.0000028E 00	1.0000000E 00
LAMBDA-OCP	1.0324591E-01	8.7393373E-01	2.5421842E 00	3.2472920E 00	3.3388731E 00	3.3388825E 00
UPSILON-PCP	8.7105434E 09	3.4301914E 09	3.5376193E 09	9.2315688E 09	8.9783586E 11	8.9783332E 13
UPSILON-GCP	5.2204217E 08	1.3256610E 09	1.2854043E 09	4.9257836E 08	5.0647019E 06	5.0647162E 04
DELTA	3.6142538E 08	1.0509107E 10	3.3811904E 10	3.8797029E 01	-0.	-0.
DELTA/OMEGA-CP	1.9811382E-04	4.8760438E-02	4.5635195E-01	6.6887211E-10	-0.	-0.
OMEGA-QP	1.8243320E 12	2.1552528E 11	7.4091725E 10	5.8003657E 10	5.6412690E 10	5.6412531E 10
OMEGA-QP/OMEGA-P	3.2339126E 01	3.8205213E 00	1.3133913E 00	1.0282052E 00	1.0000028E 00	1.0000000E 00
LAMBDA-OQP	1.0324591E-01	8.7393372E-01	2.5421842E 00	3.2472920E 00	3.3388731E 00	3.3388824E 00
UPSILON-PQP	8.7105434E 09	3.4301914E 09	3.5376193E 09	9.2315688E 09	8.9783586E 11	8.9783332E 13
UPSILON-GQP	5.2204217E 08	1.3256610E 09	1.2854043E 09	4.9257836E 08	5.0647019E 06	5.0647162E 04
DELTA-Q	3.6142538E 08	1.0509107E 10	3.3811903E 10	3.8797029E 01	-0.	-0.
DELTA-Q/OMEGA-QP	1.9811382E-04	4.8760438E-02	4.5635195E-01	6.6887211E-10	-0.	-0.

WITHOUT OMEGA-CP APPROXIMATELY EQUAL TO OMEGA-P

OMEGA-CP	2.9781247E 11	1.1789062E 11	7.4687465E 10	5.7937498E 10	5.6412539E 10	5.6412532E 10
OMEGA-CP/OMEGA-P	5.2791899E 00	2.0897948E 00	1.3239516E 00	1.0270324E 00	1.0000001E 00	1.0000000E 00
LAMBDA-OCP	6.3246113E-01	1.5977082E 00	2.5219066E 00	3.2510001E 00	3.3388820E 00	3.3388824E 00
UPSILON-PCP	1.4219498E 09	1.8762875E 09	3.5660638E 09	9.2210393E 09	8.9783347E 11	8.9783335E 13
UPSILON-GCP	1.2306153E 09	1.1929433E 09	1.1596905E 09	4.7102111E 08	5.0647172E 06	5.0647160E 04
DELTA	5.2968747E 09	2.0100000E 10	8.5781246E 09	9.5312500E 00	0.	0.
DELTA/OMEGA-CP	1.7785940E-02	1.7049702E-01	1.1485360E-01	1.6450917E-10	0.	0.

TABLE V. - Continued. DISPERSION AND DAMPING IN A THERMAL PLASMA

N-E= 1.0E 15
LAMBDA-I= 1.0000003E-05 E-F-0= 3.6457455E-05 T-E-0= 4.2307020E-01 OMEGA-P= 1.7839209E 12 LAMBDA-OP= 1.0558473E-01

T-E= 1.0E 01
P-E= 1.3624228E-06 LAMBDA-S= 6.9014319E-07 DELTA-Q/DELTA ARG= 6.8123071E-01 DELTA-Q/DELTA= 1.0791606E 00

LAMBDA-W	1.0000000E-06	3.0000000E-06	1.0000000E-05	3.0000000E-05	9.9999999E-05	9.9999999E-03
K	6.2831852E 06	2.0943951E 06	6.2831852E 05	2.0943951E 05	6.2831852E 04	6.2831852E 02
OMEGA-0	1.8835481E 17	6.2784938E 16	1.8835481E 16	6.2784938E 15	1.8835481E 15	1.8835481E 13
EPSILON	9.9999999E-01	9.9999999E-01	9.9999998E-01	9.9999992E-01	9.9999909E-01	9.9102988E-01
V-EMP	2.9977600E 10	2.9977600E 10	2.9977600E 10	2.9977601E 10	2.9977613E 10	3.0112962E 10
P						
OMEGA-CP	5.2099791E 13	7.3745730E 12	2.2870796E 12	1.8398274E 12	1.7889524E 12	1.7839214E 12
OMEGA-CP/OMEGA-P	2.9205214E 01	4.1339126E 00	1.2820521E 00	1.0313391E 00	1.0028205E 00	1.0000003E 00
LAMBDA-OCP	3.6152700E-03	2.5541115E-02	8.2356038E-02	1.0237635E-01	1.0528777E-01	1.0558471E-01
UPSILON-PCP	8.2713393E 06	3.5210993E 06	3.6400002E 06	8.7845289E 06	2.8472063E 07	2.8391990E 09
UPSILON-GCP	5.4839656E 05	1.2914350E 06	1.2492502E 06	5.1764542E 05	1.5970993E 05	1.6016035E 03
DELTA	1.3350578E 10	2.9139214E 11	9.5989417E 11	1.4961931E 04	-0.	-0.
DELTA/OMEGA-CP	2.5625012E-04	3.9513085E-02	4.1970300E-01	8.1322471E-09	-0.	-0.
OMEGA-OP	1.9845572E 14	9.1814362E 12	2.3017151E 12	1.8400081E 12	1.7889539E 12	1.7839214E 12
OMEGA-OP/OMEGA-P	1.1124693E 02	5.1467732E 00	1.2902563E 00	1.0314404E 00	1.0028213E 00	1.0000003E 00
LAMBDA-OCP	9.4910247E-04	2.0514744E-02	8.1832372E-02	1.0236630E-01	1.0528768E-01	1.0558470E-01
UPSILON-PCP	3.1595208E 07	4.3838129E 06	3.6632935E 06	8.7853914E 06	2.8472086E 07	2.8391990E 09
UPSILON-GCP	9.8150231E 05	1.7077757E 06	1.3135196E 06	5.2094025E 05	1.5980271E 05	1.6016036E 03
DELTA-Q	1.4407417E 10	3.1445889E 11	1.0359799E 12	1.6146326E 04	-0.	-0.
DELTA-Q/OMEGA-OP	7.2597640E-03	3.4249423E-02	4.5004696E-01	8.7751385E-09	-0.	-0.

WITHOUT OMEGA-CP APPROXIMATELY EQUAL TO OMEGA-P

OMEGA-CP	8.9996083E 12	3.8566396E 12	2.3046438E 12	1.8390624E 12	1.7879220E 12	1.7839210E 12
OMEGA-CP/OMEGA-P	5.0448472E 00	2.1618893E 00	1.2919264E 00	1.0309103E 00	1.0022428E 00	1.0000000E 00
LAMBDA-OCP	2.0927223E-02	4.8831102E-02	8.1726964E-02	1.0241894E-01	1.0534845E-01	1.0558473E-01
UPSILON-PCP	1.4323322E 06	1.8414048E 06	3.6680183E 06	8.7804760E 06	2.8455662E 07	2.8391984E 09
UPSILON-GCP	1.2304912E 06	1.2047833E 06	1.2047992E 06	4.9143203E 05	1.5918859E 05	1.6016038E 03
DELTA	1.7734373E 11	5.9843739E 11	2.3671872E 11	3.5390625E 03	0.	0.
DELTA/OMEGA-CP	1.9705716E-02	1.5517068E-01	1.0271202E-01	1.9243841E-09	0.	0.

N-E= 1.0E 15
LAMBDA-I= 1.0000003E-05 E-F-0= 3.6457455E-05 T-E-0= 4.2307020E-01 OMEGA-P= 1.7839209E 12 LAMBDA-OP= 1.0558473E-01

T-E= 1.0E 02
P-E= 1.3624228E-05 LAMBDA-S= 2.1824244E-06 DELTA-Q/DELTA ARG= 6.8123070E-02 DELTA-Q/DELTA= 1.0007733E 00

LAMBDA-W	3.0000000E-06	1.0000000E-05	3.0000000E-05	9.9999999E-05	9.9999999E-03	1.0000000E 00
K	2.0943951E 06	6.2831852E 05	2.0943951E 05	6.2831852E 04	6.2831852E 02	6.2831852E 00
OMEGA-0	6.2784938E 16	1.8835481E 16	6.2784938E 15	1.8835481E 15	1.8835481E 13	1.8835481E 11
EPSILON	9.9999999E-01	9.9999998E-01	9.9999992E-01	9.9999909E-01	9.9102988E-01	
V-EMP	2.9977600E 10	2.9977600E 10	2.9977601E 10	2.9977613E 10	3.0112962E 10	
P						1.0617824E-01
OMEGA-CP	5.7690442E 13	6.9155078E 12	2.3429861E 12	1.8342367E 12	1.7839259E 12	1.7839209E 12
OMEGA-CP/OMEGA-P	3.2339126E 01	3.8205213E 00	1.3133913E 00	1.0282052E 00	1.0000028E 00	1.0000000E 00
LAMBDA-OCP	3.2649223E-03	2.7636211E-02	8.0390922E-02	1.0268839E-01	1.0558444E-01	1.0558473E-01
UPSILON-PCP	2.7545157E 07	1.0847218E 07	1.1186935E 07	2.9192784E 07	2.8392062E 09	2.8391983E 11
UPSILON-GCP	1.6508423E 06	4.1921082E 06	4.0648053E 06	1.5576695E 06	1.6015994E 04	1.6016039E 02
DELTA	1.1427274E 10	3.3232715E 11	1.0692267E 12	1.2268706E 03	-0.	-0.
DELTA/OMEGA-CP	1.9811382E-04	4.8760438E-02	4.5635193E-01	6.6887257E-10	-0.	-0.
OMEGA-OP	5.9497305E 13	6.8301433E 12	2.3431667E 12	1.8342382E 12	1.7839259E 12	1.7839209E 12
OMEGA-OP/OMEGA-P	3.3351986E 01	3.8287255E 00	1.3134725E 00	1.0282060E 00	1.0000028E 00	1.0000000E 00
LAMBDA-OCP	3.1657704E-03	2.7576992E-02	8.0384722E-02	1.0268831E-01	1.0558444E-01	1.0558473E-01
UPSILON-PCP	2.8407871E 07	1.0870511E 07	1.1187797E 07	2.9192808E 07	2.8392062E 09	2.8391983E 11
UPSILON-GCP	1.7041759E 06	4.2074606E 06	4.0671191E 06	1.5577589E 06	1.6015994E 04	1.6016039E 02
DELTA-Q	1.1438113E 10	3.3258413E 11	1.0700530E 12	1.2278194E 03	-0.	-0.
DELTA-Q/OMEGA-OP	1.9224589E-04	4.8693580E-02	4.5666961E-01	6.6938928E-10	-0.	-0.

WITHOUT OMEGA-CP APPROXIMATELY EQUAL TO OMEGA-P

OMEGA-CP	9.4174995E 12	3.7292955E 12	2.3621052E 12	1.8312499E 12	1.7839220E 12	1.7839210E 12
OMEGA-CP/OMEGA-P	5.2791016E 00	2.0905049E 00	1.3241087E 00	1.0265309E 00	1.0000006E 00	1.0000000E 00
LAMBDA-OCP	2.0600512E-02	5.0506808E-02	7.9740230E-02	1.0285588E-01	1.0558467E-01	1.0558473E-01
UPSILON-PCP	4.4965248E 06	5.9353582E 06	1.1278222E 07	2.9145247E 07	2.8392000E 09	2.8391984E 11
UPSILON-GCP	3.8316779E 06	3.7691216E 06	3.6666385E 06	1.4916181E 06	1.6016019E 04	1.6016036E 02
DELTA	1.6749959E 11	6.3593739E 11	2.7199371E 11	3.0937500E 02	0.	0.
DELTA/OMEGA-CP	1.7786036E-02	1.7052481E-01	1.1476784E-01	1.6834199E-10	0.	0.

TABLE V. - Continued. DISPERSION AND DAMPING IN A THERMAL PLASMA

N-E= 1.0E 15
LAMBDA-I= 1.0000003E-05 E-F-0= 3.6457455E-05 T-E-0= 4.2307020E-01 OMEGA-P= 1.7839209E 12 LAMBDA-OP= 1.0558473E-01

T-E= 1.0E 03
P-E= 1.3624228E-04 LAMBDA-S= 6.4014310E-06 DELTA-Q/DELTA ARG= 6.8123071E-03 DELTA-Q/DELTA= 1.0000083E 00

LAMBDA-W	1.0000000E-05	3.0000000E-05	9.9999999E-05	3.0000000E-04	9.9999999E-03	1.0000000E 00
K	6.2831852E 05	2.0943951E 05	6.2831852E 04	2.0943951E 04	6.2831852E 02	6.2831852E 00
OMEGA-0	1.8835481E 16	6.2784938E 15	1.8835481E 15	6.2784938E 14	1.8835481E 13	1.8835481E 11
EPSILON	9.9999998E-01	9.9999992E-01	9.9999909E-01	9.9999192E-01	9.9102988E-01	
V-EMP	2.9977600E 10	2.9977601E 10	2.9977613E 10	2.9977721E 10	3.0112962E 10	
P						1.0617824E-01
OMEGA-CP	5.2099791E 13	7.3745730E 12	2.2870796E 12	1.8398274E 12	1.7839712E 12	1.7839209E 12
OMEGA-CP/OMEGA-P	2.9202214E 01	4.1339126E 00	1.2820521E 00	1.0313391E 00	1.0000282E 00	1.0000000E 00
LAMBDA-OCP	3.6152700E-03	2.5541115E-02	8.2356038E-02	1.0237635E-01	1.0558176E-01	1.0558473E-01
UPSILON-PCP	8.2913354E 07	3.5210993E 07	3.6400002E 07	8.7845289E 07	2.8392783E 09	2.8391983E 11
UPSILON-GCP	5.4839657E 06	1.2914351E 07	1.2492502E 07	5.1764541E 06	1.6015588E 05	1.6016039E 03
DELTA	1.3350578E 10	2.9139214E 11	9.5989417E 11	1.4961918E 04	-0.	-0.
DELTA/OMEGA-CP	2.5625012E-04	3.9513086E-02	4.1970300E-01	8.1322398E-09	-0.	-0.
OMEGA-QP	5.2114476E 13	7.3747537E 12	2.2870810E 12	1.8398274E 12	1.7839712E 12	1.7839209E 12
OMEGA-QP/OMEGA-P	2.9213418E 01	4.1340149E 00	1.2820530E 00	1.0313391E 00	1.0000282E 00	1.0000000E 00
LAMBDA-OQP	3.6142547E-03	2.5540488E-02	8.2355984E-02	1.0237635E-01	1.0558176E-01	1.0558473E-01
UPSILON-PQP	8.2942686E 07	3.5211855E 07	3.6400025E 07	8.7845289E 07	2.8392783E 09	2.8391983E 11
UPSILON-GQP	5.4856149E 06	1.2914869E 07	1.2492567E 07	5.1764575E 06	1.6015588E 05	1.6016039E 03
DELTA-Q	1.3350689E 10	2.9139456E 11	9.5990216E 11	1.4962042E 04	-0.	-0.
DELTA-Q/OMEGA-QP	2.5614029E-04	3.9512447E-02	4.1970623E-01	8.1323075E-09	-0.	-0.

WITHOUT OMEGA-CP APPROXIMATELY EQUAL TO OMEGA-P

OMEGA-CP	8.9996083E 12	3.8566396E 12	2.3046638E 12	1.8390624E 12	1.7839220E 12	1.7839210E 12
OMEGA-CP/OMEGA-P	5.0448472E 00	2.1618893E 00	1.2919204E 00	1.0309103E 00	1.0000006E 00	1.0000000E 00
LAMBDA-OCP	2.0922223E-02	4.8839102E-02	8.1726964E-02	1.0241894E-01	1.0558467E-01	1.0558473E-01
UPSILON-PCP	1.4323322E 07	1.8414098E 07	3.6680183E 07	8.7808762E 07	2.8392000E 09	2.8391984E 11
UPSILON-GCP	1.2304912E 07	1.2047833E 07	1.2047793E 07	4.9143203E 06	1.6016110E 05	1.6016037E 03
DELTA	1.7734373E 11	5.9843739E 11	2.3671872E 11	1.5390625E 03	0.	0.
DELTA/OMEGA-CP	1.9705716E-02	1.5517068E-01	1.0271202E-01	1.9243841E-09	0.	0.

N-E= 1.0E 15
LAMBDA-I= 1.0000003E-05 E-F-0= 3.6457455E-05 T-E-0= 4.2307020E-01 OMEGA-P= 1.7839209E 12 LAMBDA-OP= 1.0558473E-01

T-E= 1.0E 04
P-E= 1.3624228E-03 LAMBDA-S= 2.1824244E-05 DELTA-Q/DELTA ARG= 6.8123071E-04 DELTA-Q/DELTA= 1.0000000E 00

LAMBDA-W	3.0000000E-05	9.9999999E-05	3.0000000E-04	9.9999999E-04	9.9999999E-03	1.0000000E 00
K	2.0943951E 05	6.2831852E 04	2.0943951E 04	6.2831853E 03	6.2831852E 02	6.2831852E 00
OMEGA-0	6.2784938E 15	1.8835481E 15	6.2784938E 14	1.8835482E 14	1.8835481E 13	1.8835481E 11
EPSILON	9.9999992E-01	9.9999909E-01	9.9999192E-01	9.9991030E-01	9.9102988E-01	
V-EMP	2.9977601E 10	2.9977613E 10	2.9977721E 10	2.9978944E 10	3.0112962E 10	
P						1.0617824E-01
OMEGA-CP	5.7690444E 13	6.8155079E 12	2.3429861E 12	1.8342367E 12	1.7844240E 12	1.7839209E 12
OMEGA-CP/OMEGA-P	3.2339127E 01	3.8205214E 00	1.3133913E 00	1.0282052E 00	1.0002820E 00	1.0000000E 00
LAMBDA-OCP	3.2649222E-03	2.7636210E-02	8.0390721E-02	1.0268839E-01	1.0555496E-01	1.0558473E-01
UPSILON-PCP	2.7545158E 08	1.0847218E 08	1.1186935E 08	2.9192784E 08	2.8399991E 09	2.8391983E 11
UPSILON-GCP	1.6508423E 07	4.1921082E 07	4.0648053E 07	1.5576696E 07	1.6011523E 06	1.6016039E 04
DELTA	1.1429274E 10	3.3232714E 11	1.0692263E 12	1.2268715E 03	-0.	-0.
DELTA/OMEGA-CP	1.9811381E-04	4.8760436E-02	4.5635195E-01	6.6887303E-10	-0.	-0.
OMEGA-QP	5.7690624E 13	6.8155093E 12	2.3429861E 12	1.8342367E 12	1.7844240E 12	1.7839209E 12
OMEGA-QP/OMEGA-P	3.2339228E 01	3.8205222E 00	1.3133913E 00	1.0282052E 00	1.0002820E 00	1.0000000E 00
LAMBDA-OQP	3.2649120E-03	2.7636204E-02	8.0390721E-02	1.0268839E-01	1.0555496E-01	1.0558473E-01
UPSILON-PQP	2.7545244E 08	1.0847220E 08	1.1186935E 08	2.9192784E 08	2.8399991E 09	2.8391983E 11
UPSILON-GQP	1.6508478E 07	4.1921098E 07	4.0648055E 07	1.5576696E 07	1.6011523E 06	1.6016039E 04
DELTA-Q	1.1429274E 10	3.3232714E 11	1.0692263E 12	1.2268715E 03	-0.	-0.
DELTA-Q/OMEGA-QP	1.9811319E-04	4.8760426E-02	4.5635195E-01	6.6887303E-10	-0.	-0.

WITHOUT OMEGA-CP APPROXIMATELY EQUAL TO OMEGA-P

OMEGA-CP	9.4174995E 12	3.7292955E 12	2.3621052E 12	1.8312499E 12	1.7839220E 12	1.7839210E 12
OMEGA-CP/OMEGA-P	5.2791016E 00	2.0905049E 00	1.3241367E 00	1.0263309E 00	1.0000006E 00	1.0000000E 00
LAMBDA-OCP	2.0005512E-02	5.0506808E-02	7.9740230E-02	1.0285588E-01	1.0558467E-01	1.0558473E-01
UPSILON-PCP	4.4965248E 07	5.9353581E 07	1.1278222E 08	2.9145247E 08	2.8392000E 09	2.8391984E 11
UPSILON-GCP	3.8316780E 07	3.7691218E 07	3.6666385E 07	1.4916182E 07	1.6017011E 06	1.6016037E 04
DELTA	1.6749999E 11	6.3593739E 11	2.7109371E 11	3.0937500E 02	0.	0.
DELTA/OMEGA-CP	1.7786036E-02	1.7052481E-01	1.1476764E-01	1.6894199E-10	0.	0.

TABLE V. - Continued. DISPERSION AND DAMPING IN A THERMAL PLASMA

N-E= 1.0E 15
LAMBDA-I= 1.0000003E-05 E-F-0= 3.6457455E-05 T-E-0= 4.2307020E-01 OMEGA-P= 1.7839209E 12 LAMBDA-DP= 1.0558473E-01

T-E= 1.0E 05
P-E= 1.3624228E-02 LAMBDA-S= 6.9014319E-05 DELTA-Q/DELTA ARG= 6.8123070E-05 DELTA-Q/DELTA= 1.0000000E 00

LAMBDA-W	9.9999999E-05	3.0000000E-04	9.9999999E-04	3.0000000E-03	9.9999999E-03	1.0000000E 00
K	6.2831852E 04	2.0943951E 04	6.2831853E 03	2.0943951E 03	6.2831852E 02	6.2831852E 00
OMEGA-0	1.8835481E 15	6.2784938E 14	1.8835482E 14	6.2784937E 13	1.8835481E 13	1.8835481E 11
EPSILON	9.9999909E-01	9.9999192E-01	9.9991030E-01	9.9919268E-01	9.9102988E-01	
V-EMP	2.9977613E 10	2.9977721E 10	2.9978944E 10	2.9989707E 10	3.0112962E 10	
P						1.0617824E-01
OMEGA-CP	5.2099791E 13	7.3745730E 12	2.2870796E 12	1.8398274E 12	1.7889524E 12	1.7839214E 12
OMEGA-CP/OMEGA-P	2.9205214E 01	4.1339126E 00	1.2820521E 00	1.0313391E 00	1.0028205E 00	1.0000003E 00
LAMBDA-DCP	3.6152700E-03	2.5541115E-02	8.2356038E-02	1.0237635E-01	1.0528777E-01	1.0558471E-01
UPSILON-PCP	8.2919394E 08	3.5210993E 08	3.6400002E 08	8.7845289E 08	2.8472063E 09	2.8391990E 11
UPSILON-GCP	5.4839658E 07	1.2914351E 08	1.2492503E 08	5.1764542E 07	1.5970993E 07	1.6016035E 05
DELTA	1.3350578E 10	2.9139214E 11	9.5989419E 11	1.4961931E 04	-0.	-0.
DELTA/OMEGA-CP	2.5625012E-04	3.9513085E-02	4.1970301E-01	8.1322471E-09	-0.	-0.
OMEGA-QP	5.2099792E 13	7.3745730E 12	2.2870796E 12	1.8398274E 12	1.7889524E 12	1.7839214E 12
OMEGA-QP/OMEGA-P	2.9205214E 01	4.1339126E 00	1.2820521E 00	1.0313391E 00	1.0028205E 00	1.0000003E 00
LAMBDA-DQP	3.6152699E-03	2.5541114E-02	8.2356037E-02	1.0237635E-01	1.0528777E-01	1.0558470E-01
UPSILON-PQP	8.2919395E 08	3.5210993E 08	3.6400002E 08	8.7845289E 08	2.8472063E 09	2.8391990E 11
UPSILON-GQP	5.4839660E 07	1.2914351E 08	1.2492503E 08	5.1764542E 07	1.5970993E 07	1.6016035E 05
DELTA-Q	1.3350577E 10	2.9139213E 11	9.5989417E 11	1.4961931E 04	-0.	-0.
DELTA-Q/OMEGA-QP	2.5625011E-04	3.9513085E-02	4.1970301E-01	8.1322471E-09	-0.	-0.

WITHOUT OMEGA-CP APPROXIMATELY EQUAL TO OMEGA-P

OMEGA-CP	8.9996083E 12	3.8566396E 12	2.3050740E 12	1.8390624E 12	1.7879220E 12	1.7839210E 12
OMEGA-CP/OMEGA-P	5.0446472E 00	2.1618893E 00	1.2921392E 00	1.0309103E 00	1.0022428E 00	1.0000000E 00
LAMBDA-DCP	2.0929223E-02	4.8839102E-02	8.1713128E-02	1.0241894E-01	1.0534845E-01	1.0558473E-01
UPSILON-PCP	1.4323322E 08	1.8414098E 08	3.6686393E 08	8.7808762E 08	2.8455662E 09	2.8391984E 11
UPSILON-GCP	1.2304912E 08	1.2047834E 08	1.2047335E 08	4.9143204E 07	1.5918860E 07	1.6016038E 05
DELTA	1.7734373E 11	5.9843739E 11	2.3671872E 11	3.5390625E 03	0.	0.
DELTA/OMEGA-CP	1.9705716E-02	1.5517068E-01	1.0269463E-01	1.9243841E-09	0.	0.

N-E= 1.0E 15
LAMBDA-I= 1.0000003E-05 E-F-0= 3.6457455E-05 T-E-0= 4.2307020E-01 OMEGA-P= 1.7839209E 12 LAMBDA-DP= 1.0558473E-01

T-E= 1.0E 06
P-E= 1.3624227E-01 LAMBDA-S= 2.1824244E-04 DELTA-Q/DELTA ARG= 6.8123071E-06 DELTA-Q/DELTA= 1.0000000E 00

LAMBDA-W	3.0000000E-04	9.9999999E-04	3.0000000E-03	9.9999999E-03	1.0000000E 00	1.0000000E 02
K	2.0943951E 04	6.2831853E 03	2.0943951E 03	6.2831852E 02	6.2831852E 00	6.2831851E-02
OMEGA-0	6.2784938E 14	1.8835482E 14	6.2784937E 13	1.8835481E 13	1.8835481E 11	1.8835481E 09
EPSILON	9.9999192E-01	9.9991030E-01	9.9919268E-01	9.9102988E-01		
V-EMP	2.9977721E 10	2.9978944E 10	2.9989707E 10	3.0112962E 10		
P					1.0617824E-01	1.0558479E-01
OMEGA-CP	5.7690441E 13	6.8155079E 12	2.3429861E 12	1.8342367E 12	1.7839259E 12	1.7839209E 12
OMEGA-CP/OMEGA-P	3.2339125E 01	3.8205214E 00	1.3133913E 00	1.0282052E 00	1.0000028E 00	1.0000000E 00
LAMBDA-DCP	3.2649224E-03	2.7636210E-02	8.0390922E-02	1.0268839E-01	1.0558444E-01	1.0558473E-01
UPSILON-PCP	2.7545157E 09	1.0847218E 09	1.1186934E 09	2.9192784E 09	2.8392063E 11	2.8391984E 13
UPSILON-GCP	1.6508423E 08	4.1921083E 08	4.0648053E 08	1.5576695E 08	1.6015994E 06	1.6016039E 04
DELTA	1.1429275E 10	3.3232714E 11	1.0692262E 12	1.2268706E 03	-0.	-0.
DELTA/OMEGA-CP	1.9811384E-04	4.8760436E-02	4.5635193E-01	6.6887257E-10	-0.	-0.
OMEGA-QP	5.7690441E 13	6.8155079E 12	2.3429861E 12	1.8342367E 12	1.7839259E 12	1.7839209E 12
OMEGA-QP/OMEGA-P	3.2339125E 01	3.8205214E 00	1.3133913E 00	1.0282052E 00	1.0000028E 00	1.0000000E 00
LAMBDA-DQP	3.2649224E-03	2.7636210E-02	8.0390921E-02	1.0268839E-01	1.0558444E-01	1.0558473E-01
UPSILON-PQP	2.7545157E 09	1.0847218E 09	1.1186934E 09	2.9192784E 09	2.8392063E 11	2.8391984E 13
UPSILON-GQP	1.6508423E 08	4.1921083E 08	4.0648053E 08	1.5576695E 08	1.6015994E 06	1.6016039E 04
DELTA-Q	1.1429275E 10	3.3232714E 11	1.0692262E 12	1.2268706E 03	-0.	-0.
DELTA-Q/OMEGA-QP	1.9811384E-04	4.8760436E-02	4.5635193E-01	6.6887257E-10	-0.	-0.

WITHOUT OMEGA-CP APPROXIMATELY EQUAL TO OMEGA-P

OMEGA-CP	9.4174995E 12	3.7292955E 12	2.3621052E 12	1.8312499E 12	1.7839220E 12	1.7839210E 12
OMEGA-CP/OMEGA-P	5.2791016E 00	2.0905049E 00	1.3241087E 00	1.0265309E 00	1.0000006E 00	1.0000000E 00
LAMBDA-DCP	2.0000512E-02	5.0506808E-02	7.9740230E-02	1.0285588E-01	1.0558467E-01	1.0558473E-01
UPSILON-PCP	4.4965249E 08	5.9353581E 08	1.1278221E 09	2.9145247E 09	2.8392000E 11	2.8391985E 13
UPSILON-GCP	3.8916780E 08	3.7691219E 08	3.6663385E 08	1.4916182E 08	1.6016019E 06	1.6016036E 04
DELTA	1.6749999E 11	6.3593739E 11	2.7109371E 11	3.0937500E 02	0.	0.
DELTA/OMEGA-CP	1.7786030E-02	1.7052481E-01	1.1476784E-01	1.6894199E-10	0.	0.

TABLE V. - Continued. DISPERSION AND DAMPING IN A THERMAL PLASMA

N-E= 1.0E 15
LAMBDA-I= 1.0000003E-05 E-F-0= 3.6457455E-05 T-E-0= 4.2307020E-01 OMEGA-P= 1.7839209E 12 LAMBDA-DP= 1.0558473E-01

T-E= 1.0E 07
P-E= 1.3624228E 00 LAMBDA-S= 6.9014320E-04 DELTA-Q/DELTA ARG= 6.8123071E-07 DELTA-Q/DELTA= 1.0000000E 00

LAMBDA-W	9.9999999E-04	3.0000000E-03	9.9999999E-03	3.0000000E-02	1.0000000E 00	1.0000000E 02
K	6.2831853E 03	2.0943951E 03	6.2831852E 02	2.0943951E 02	6.2831852E 00	6.2831851E-02
OMEGA-0	1.8835482E 14	6.2784937E 13	1.8835481E 13	6.2784937E 12	1.8835481E 11	1.8835481E 09
EPSILON	9.9991030E-01	9.9919268E-01	9.9102988E-01	9.1926900E-01		
V-EMP	2.9978944E 10	2.9989707E 10	3.0112962E 10	3.1266232E 10		
P					1.0617824E-01	1.0558479E-01
OMEGA-DP	5.2099792E 13	7.3745732E 12	2.2870796E 12	1.8398274E 12	1.7839712E 12	1.7839209E 12
OMEGA-DP/OMEGA-P	2.9205214E 01	4.1339127E 00	1.2820521E 00	1.0313391E 00	1.0000282E 00	1.0000000E 00
LAMBDA-DDP	3.6152699E-03	2.5541114E-02	8.2356038E-02	1.0237635E-01	1.0558176E-01	1.0558473E-01
UPSILON-PDP	8.2913394E 09	3.5210993E 09	3.6400002E 09	8.7845289E 09	2.8392783E 11	2.8391984E 13
UPSILON-GDP	5.4834657E 08	1.2914350E 09	1.2492502E 09	5.1764542E 08	1.6015588E 07	1.6016039E 05
DELTA	1.3350577E 10	2.9139213E 11	9.5389417E 11	1.4961931E 04	-0.	-0.
DELTA/OMEGA-DP	2.5625010E-04	3.9513084E-02	4.1970300E-01	8.1322471E-09	-0.	-0.
OMEGA-DP	5.2099792E 13	7.3745732E 12	2.2870796E 12	1.8398274E 12	1.7839712E 12	1.7839209E 12
OMEGA-DP/OMEGA-P	2.9205214E 01	4.1339127E 00	1.2820521E 00	1.0313391E 00	1.0000282E 00	1.0000000E 00
LAMBDA-DDP	3.6152699E-03	2.5541114E-02	8.2356037E-02	1.0237635E-01	1.0558176E-01	1.0558473E-01
UPSILON-PDP	8.2913394E 09	3.5210993E 09	3.6400002E 09	8.7845289E 09	2.8392783E 11	2.8391984E 13
UPSILON-GDP	5.4834657E 08	1.2914350E 09	1.2492502E 09	5.1764542E 08	1.6015588E 07	1.6016039E 05
DELTA-Q	1.3350577E 10	2.9139213E 11	9.5389416E 11	1.4961931E 04	-0.	-0.
DELTA-Q/OMEGA-DP	2.5625010E-04	3.9513084E-02	4.1970300E-01	8.1322471E-09	-0.	-0.

WITHOUT OMEGA-DP APPROXIMATELY EQUAL TO OMEGA-P

OMEGA-DP	8.9996083E 12	3.8566396E 12	2.3050740E 12	1.8390624E 12	1.7839220E 12	1.7839210E 12
OMEGA-DP/OMEGA-P	5.0448472E 00	2.1618893E 00	1.2921392E 00	1.0309103E 00	1.0000006E 00	1.0000000E 00
LAMBDA-DDP	2.0929223E-02	4.8839102E-02	8.1713128E-02	1.0241894E-01	1.0558467E-01	1.0558473E-01
UPSILON-PDP	1.4323322E 09	1.8414098E 09	3.6686393E 09	8.7808759E 09	2.8392000E 11	2.8391985E 13
UPSILON-GDP	1.2304912E 09	1.2047834E 09	1.2047336E 09	4.9143203E 08	1.6016110E 07	1.6016036E 05
DELTA	1.7734373E 11	5.9843739E 11	2.3671872E 11	3.5390625E 03	0.	0.
DELTA/OMEGA-DP	1.9705716E-02	1.5517068E-01	1.0269463E-01	1.9243841E-09	0.	0.

N-E= 1.0E 18
LAMBDA-I= 1.0000004E-06 E-F-0= 3.6457448E-03 T-E-0= 4.2307012E 01 OMEGA-P= 5.6412532E 13 LAMBDA-DP= 3.3388825E-03

T-E= 1.0E 01
P-E= 1.3624228E-03 LAMBDA-S= 2.1824244E-08 DELTA-Q/DELTA ARG= 2.1542406E 01 DELTA-Q/DELTA= 5.2653115E 07

LAMBDA-W	3.0000000E-08	9.9999999E-08	3.0000000E-07	1.0000000E-06	9.9999999E-05	9.9999999E-03
K	2.0943951E 08	6.2831852E 07	2.0943951E 07	6.2831852E 06	6.2831852E 04	6.2831852E 02
OMEGA-0	6.2784937E 18	1.8835481E 18	6.2784938E 17	1.8835481E 17	1.8835481E 15	1.8835481E 13
EPSILON	9.9999999E-01	9.9999999E-01	9.9999998E-01	9.9999989E-01	9.9910299E-01	
V-EMP	2.9977600E 10	2.9977600E 10	2.9977600E 10	2.9977601E 10	2.9991054E 10	
P						3.5421574E-03
OMEGA-DP	1.8243320E 15	2.1552528E 14	7.4091725E 13	5.8003658E 13	5.6412691E 13	5.6412532E 13
OMEGA-DP/OMEGA-P	3.2333126E 01	3.8205214E 00	1.3133913E 00	1.0282052E 00	1.0000028E 00	1.0000000E 00
LAMBDA-DDP	1.0324591E-04	8.7393371E-04	2.5421842E-03	3.2472920E-03	3.3388731E-03	3.3388825E-03
UPSILON-PDP	8.7105435E 06	3.4301915E 06	3.5376193E 06	9.2315689E 06	8.9783586E 08	8.9783332E 10
UPSILON-GDP	5.2204217E 05	1.3256610E 06	1.2854043E 06	4.9257836E 05	5.0647020E 03	5.0647163E 01
DELTA	3.6142538E 11	1.0509107E 13	3.3811902E 13	3.8797057E 04	-0.	-0.
DELTA/OMEGA-DP	1.9811382E-04	4.8769436E-02	4.5635193E-01	6.6887257E-10	-0.	-0.
OMEGA-DP	5.7156275E 18	4.6497333E 16	6.4547204E 14	6.2031839E 13	5.6412691E 13	5.6412532E 13
OMEGA-DP/OMEGA-P	1.0131840E 05	8.2423764E 02	1.1441997E 01	1.1102469E 00	1.0000028E 00	1.0000000E 00
LAMBDA-DDP	3.2954353E-08	4.0508734E-06	2.9180940E-04	3.0073332E-03	3.3388730E-03	3.3388824E-03
UPSILON-PDP	2.7290111E 10	7.4002804E 08	3.0819020E 07	9.9681668E 06	8.9783586E 08	8.9783332E 10
UPSILON-GDP	1.0772227E 06	3.5808315E 06	9.6448338E 06	3.1099956E 06	5.0676484E 03	5.0647166E 01
DELTA-Q	1.9030172E 19	5.5333721E 20	1.7803020E 21	2.0427858E 12	-0.	-0.
DELTA-Q/OMEGA-DP	3.4234983E 00	1.1900408E 04	2.7581396E 06	3.2615773E-02	-0.	-0.

WITHOUT OMEGA-DP APPROXIMATELY EQUAL TO OMEGA-P

OMEGA-DP	2.9785154E 14	1.1789061E 14	7.4687490E 13	5.7968748E 13	5.6412532E 13	5.6412532E 13
OMEGA-DP/OMEGA-P	5.2799824E 00	2.0897947E 00	1.3239521E 00	1.0275863E 00	1.0000000E 00	1.0000000E 00
LAMBDA-DDP	6.3237818E-04	1.5977084E-03	2.5219058E-03	3.2492476E-03	3.3388824E-03	3.3388824E-03
UPSILON-PDP	1.4221363E 06	1.8762873E 06	3.5660659E 06	9.2260127E 06	8.9783335E 08	8.9783332E 10
UPSILON-GDP	1.2302905E 06	1.1727135E 06	1.1599671E 06	4.7028248E 05	5.0647193E 03	5.0647160E 01
DELTA	5.2968745E 12	2.0124939E 13	8.5749996E 12	9.2500000E 03	0.	0.
DELTA/OMEGA-DP	1.7783607E-02	1.7070909E-01	1.1481173E-01	1.5956874E-10	0.	0.

TABLE V. - Continued. DISPERSION AND DAMPING IN A THERMAL PLASMA

N-E= 1.0E 14
LAMBDA-I= 1.0000004E-06 E-F-O= 3.6457448E-03 T-E-O= 4.2307012E 01 OMEGA-P= 5.6412532E 13 LAMBDA-OP= 3.3388825E-03

T-E= 1.0E 02
P-E= 1.3024227E-02 LAMBDA-S= 6.9014319E-06 DELTA-Q/DELTA ARG= 2.1542406E 00 DELTA-Q/DELTA= 1.9740946E 00

LAMBDA-W	9.9999999E-06	3.0000000E-07	1.0000000E-06	3.0000000E-06	9.9999999E-05	9.9999999E-03
K	6.2831852E 07	2.0943951E 07	6.2831852E 06	2.0943951E 06	6.2831852E 04	6.2831852E 02
OMEGA-Q	1.8835481E 16	6.2784938E 17	1.8835481E 17	6.2784938E 16	1.8835481E 15	1.8835481E 13
EPSILON	9.9999999E-01	9.9999998E-01	9.9999989E-01	9.9999918E-01	9.9910299E-01	
V-EMP	2.9977600E 10	2.9977601E 10	2.9977601E 10	2.9977612E 10	2.9991054E 10	
P						3.5421574E-03
OMEGA-CP	1.6475400E 15	2.3120448E 14	7.2323806E 13	5.8180451E 13	5.6414122E 13	5.6412532E 13
OMEGA-CP/OMEGA-P	2.9205213E 01	4.1339126E 00	1.2820521E 00	1.0313391E 00	1.0000282E 00	1.0000000E 00
LAMBDA-OCP	1.1432468E-04	8.0768095E-04	2.6043266E-03	3.2374244E-03	3.3387884E-03	3.3388825E-03
OPSILON-PCP	2.6221414E 07	1.1134693E 07	1.1510091E 07	2.7779119E 07	8.9785864E 08	8.9783332E 10
OPSILON-OCP	1.7341823E 06	4.0838763E 06	3.9504761E 06	1.6369385E 06	5.0645735E 04	5.0647163E 02
DELTA	4.2218236E 11	9.2146288E 12	3.0354518E 13	4.7313738E 05	-0.	-0.
DELTA/OMEGA-CP	2.5625014E-04	3.9513087E-02	4.1970298E-01	8.1322398E-09	-0.	-0.
OMEGA-OP	4.7929342E 16	8.0454477E 14	7.6351986E 13	5.8237588E 13	5.6414122E 13	5.6412532E 13
OMEGA-OP/OMEGA-P	8.4962226E 02	1.4262518E 01	1.3640938E 00	1.0323520E 00	1.0000282E 00	1.0000000E 00
LAMBDA-OOP	3.7284434E-06	2.3410149E-04	2.4476927E-03	3.2342481E-03	3.3387883E-03	3.3388824E-03
OPSILON-POP	7.6281918E 08	3.8416093E 07	1.2247280E 07	2.7806400E 07	8.9785864E 08	8.9783332E 10
OPSILON-OOP	3.5274951E 06	8.8340044E 06	5.8728420E 06	1.7410383E 06	5.0648681E 04	5.0647163E 02
DELTA-Q	8.3342788E 11	1.8190548E 13	5.9922687E 13	9.3401793E 05	-0.	-0.
DELTA-Q/OMEGA-OP	1.7388678E-05	2.2608616E-02	7.7870229E-01	1.6038060E-08	-0.	-0.

WITHOUT OMEGA-CP APPROXIMATELY EQUAL TO OMEGA-P

OMEGA-OP	2.8461912E 14	1.2195312E 14	7.2874991E 13	5.8124998E 13	5.6412534E 13	5.6412532E 13
OMEGA-OP/OMEGA-P	5.0453172E 00	2.1618090E 00	1.2918227E 00	1.0303561E 00	1.0000000E 00	1.0000000E 00
LAMBDA-OOP	6.6177850E-04	1.5444854E-03	2.5846290E-03	3.2405130E-03	3.3388823E-03	3.3388824E-03
OPSILON-POP	4.5248539E 08	5.8228325E 06	1.1598415E 07	2.7752643E 07	8.9783337E 08	8.9783332E 10
OPSILON-OOP	3.8904251E 06	3.8102400E 06	3.8102731E 06	1.5564710E 06	5.0647473E 04	5.0647160E 02
DELTA	5.6093746E 12	1.8406249E 13	7.4874995E 12	1.1500000E 05	0.	0.
DELTA/OMEGA-OP	1.9704355E-02	1.5502882E-01	1.0274443E-01	1.9784946E-09	0.	0.

N-E= 1.0E 14
LAMBDA-I= 1.0000004E-06 E-F-O= 3.6457448E-03 T-E-O= 4.2307012E 01 OMEGA-P= 5.6412532E 13 LAMBDA-OP= 3.3388825E-03

T-E= 1.0E 03
P-E= 1.3024227E-01 LAMBDA-S= 2.1824244E-07 DELTA-Q/DELTA ARG= 2.1542406E-01 DELTA-Q/DELTA= 1.0077525E 00

LAMBDA-W	3.0000000E-07	1.0000000E-06	3.0000000E-06	1.0000000E-05	9.9999999E-05	9.9999999E-03
K	2.0943951E 07	6.2831852E 06	2.0943951E 06	6.2831852E 05	6.2831852E 04	6.2831852E 02
OMEGA-Q	6.2784938E 17	1.8835481E 17	6.2784938E 16	1.8835481E 16	1.8835481E 15	1.8835481E 13
EPSILON	9.9999998E-01	9.9999989E-01	9.9999918E-01	9.9999102E-01	9.9910299E-01	
V-EMP	2.9977600E 10	2.9977601E 10	2.9977612E 10	2.9977734E 10	2.9991054E 10	
P						3.5421574E-03
OMEGA-CP	1.8243320E 15	2.1552528E 14	7.4031725E 13	5.8003658E 13	5.6428443E 13	5.6412532E 13
OMEGA-CP/OMEGA-P	3.2339126E 01	3.8205213E 00	1.3133913E 00	1.0282052E 00	1.0002820E 00	1.0000000E 00
LAMBDA-OCP	1.0324531E-04	8.7393373E-04	2.5421842E-03	3.2472920E-03	3.3379410E-03	3.3388824E-03
OPSILON-PCP	8.7105436E 07	3.4301913E 07	3.5376194E 07	9.2315689E 07	8.9808657E 08	8.9783332E 10
OPSILON-OCP	5.2204214E 06	1.3256610E 07	1.2854043E 07	4.9257834E 06	5.0632880E 05	5.0647161E 03
DELTA	3.6142538E 11	1.0509107E 13	3.3811902E 13	3.8797030E 04	-0.	-0.
DELTA/OMEGA-CP	1.9811382E-04	4.8760438E-02	4.5635193E-01	6.6887211E-10	-0.	-0.
OMEGA-OP	2.3957123E 15	2.2015346E 14	7.4148862E 13	5.8004121E 13	5.6428443E 13	5.6412532E 13
OMEGA-OP/OMEGA-P	4.2467731E 01	3.9025630E 00	1.3144041E 00	1.0282134E 00	1.0002820E 00	1.0000000E 00
LAMBDA-OOP	7.4221632E-05	8.5556144E-04	2.5422252E-03	3.2472660E-03	3.3379409E-03	3.3388824E-03
OPSILON-POP	1.1438634E 08	3.5038511E 07	3.5433475E 07	9.2316426E 07	8.9808657E 08	8.9783332E 10
OPSILON-OOP	6.5444564E 06	1.3732912E 07	1.2927160E 07	4.9286097E 06	5.0633175E 05	5.0647161E 03
DELTA-Q	3.6422734E 11	1.0590579E 13	3.4074029E 13	3.9097864E 04	-0.	-0.
DELTA-Q/OMEGA-OP	1.5203301E-04	4.8105440E-02	4.5953542E-01	6.7405217E-10	-0.	-0.

WITHOUT OMEGA-CP APPROXIMATELY EQUAL TO OMEGA-P

OMEGA-CP	2.9782194E 14	1.1789861E 14	7.4687490E 13	5.7968748E 13	5.6412534E 13	5.6412532E 13
OMEGA-CP/OMEGA-P	5.2798824E 00	2.0897947E 00	1.3235521E 00	1.0275863E 00	1.0000000E 00	1.0000000E 00
LAMBDA-OOP	6.3237818E-04	1.5977084E-03	2.5219058E-03	3.2492476E-03	3.3388823E-03	3.3388824E-03
OPSILON-POP	1.4221363E 07	1.8762873E 07	3.5660650E 07	3.2260127E 07	8.9783337E 08	8.9783332E 10
OPSILON-OOP	1.2302304E 07	1.1929134E 07	1.1956071E 07	4.7028248E 06	5.0650320E 05	5.0647160E 03
DELTA	5.2966745E 12	2.0124929E 13	8.5749996E 12	9.2500000E 03	0.	0.
DELTA/OMEGA-OP	1.7784607E-02	1.7070909E-01	1.1481173E-01	1.5956874E-10	0.	0.

TABLE V. - Continued. DISPERSION AND DAMPING IN A THERMAL PLASMA

N-E= 1.0E 18
LAMBDA-I= 1.0000004E-06 E-F-0= 3.6457448E-03 T-E-0= 4.2307012E 01 OMEGA-P= 5.6412532E 13 LAMBDA-OP= 3.3388825E-03

T-E= 1.0E 04
P-E= 1.3624228E 00 LAMBDA-S= 6.9014319E-07 DELTA-Q/DELTA ARG= 2.1542406E-02 DELTA-Q/DELTA= 1.0000770E 00

LAMBDA-W	1.0000000E-06	3.0000000E-06	1.0000000E-05	3.0000000E-05	9.9999999E-05	9.9999999E-03
K	6.2831852E 06	2.0943951E 06	6.2831852E 05	2.0943951E 05	6.2831852E 04	6.2831852E 02
OMEGA-0	1.8835481E 17	6.2784938E 16	1.8835481E 16	6.2784938E 15	1.8835481E 15	1.8835481E 13
EPSILON	9.9999989E-01	9.9999918E-01	9.9999102E-01	9.9991926E-01	9.9910299E-01	
V-EMP	2.9977601E 10	2.9977612E 10	2.9977734E 10	2.9978810E 10	2.9991054E 10	
P						3.5421574E-03
OMEGA-CP	1.6475401E 15	2.3320448E 14	7.2323806E 13	5.8180451E 13	5.6571643E 13	5.6412547E 13
OMEGA-CP/OMEGA-P	2.9209214E 01	4.1339126E 00	1.2820521E 00	1.0313391E 00	1.0028205E 00	1.0000003E 00
LAMBDA-OCP	1.1432488E-04	8.0768095E-04	2.6043266E-03	3.2374244E-03	3.3294917E-03	3.3388816E-03
OPSILON-PCP	2.6221415E 08	1.1134694E 08	1.1510691E 08	2.7779119E 08	9.0036567E 08	8.9783355E 10
OPSILON-GCP	1.7341823E 07	4.0838763E 07	3.9504761E 07	1.6369386E 07	5.0504715E 06	5.0647151E 04
DELTA	4.2218233E 11	9.2146283E 12	3.0354519E 13	4.7313781E 05	-0.	-0.
DELTA/OMEGA-CP	2.5625012E-04	3.9513085E-02	4.1970300E-01	8.1322471E-09	-0.	-0.
OMEGA-WP	1.6521682E 15	2.3326161E 14	7.2324269E 13	5.8180456E 13	5.6571643E 13	5.6412547E 13
OMEGA-WP/OMEGA-P	2.9267255E 01	4.1349254E 00	1.2820603E 00	1.0313392E 00	1.0028205E 00	1.0000003E 00
LAMBDA-OWP	1.1400462E-04	8.0748311E-04	2.6043099E-03	3.2374241E-03	3.3294916E-03	3.3388816E-03
OPSILON-PWP	2.6295075E 08	1.1137422E 08	1.1510765E 08	2.7779122E 08	9.0036567E 08	8.9783355E 10
OPSILON-GWP	1.7393846E 07	4.0455151E 07	3.9506807E 07	1.6369490E 07	5.0504744E 06	5.0647151E 04
DELTA-Q	4.2221484E 11	9.2153378E 12	3.0356855E 13	4.7317423E 05	-0.	-0.
DELTA-Q/OMEGA-WP	2.5555197E-04	3.9506448E-02	4.1973263E-01	8.1328726E-09	-0.	-0.

WITHOUT OMEGA-CP APPROXIMATELY EQUAL TO OMEGA-P

OMEGA-CP	2.8461912E 14	1.2195312E 14	7.2874991E 13	5.8124998E 13	5.6599999E 13	5.6412532E 13
OMEGA-CP/OMEGA-P	5.0453172E 00	2.1618090E 00	1.2918227E 00	1.0303561E 00	1.0033232E 00	1.0000000E 00
LAMBDA-OCP	6.6177850E-04	1.5444854E-03	2.5846290E-03	3.2405130E-03	3.3278236E-03	3.3388824E-03
OPSILON-PCP	4.5298540E 07	9.8228325E 07	1.1598415E 08	2.7752643E 08	9.0081698E 08	8.9783332E 10
OPSILON-GCP	3.8904251E 07	3.8102400E 07	3.8102729E 07	1.5564710E 07	5.0177956E 06	5.0647164E 04
DELTA	5.6093746E 12	1.8906249E 13	7.4874995E 12	1.1500000E 05	0.	0.
DELTA/OMEGA-CP	1.9703355E-02	1.5502862E-01	1.0274443E-01	1.9784946E-09	0.	0.

N-E= 1.0E 18
LAMBDA-I= 1.0000004E-06 E-F-0= 3.6457448E-03 T-E-0= 4.2307012E 01 OMEGA-P= 5.6412532E 13 LAMBDA-OP= 3.3388825E-03

T-E= 1.0E 05
P-E= 1.3624228E 01 LAMBDA-S= 2.1824244E-06 DELTA-Q/DELTA ARG= 2.1542406E-03 DELTA-Q/DELTA= 1.0000000E 00

LAMBDA-W	3.0000000E-06	1.0000000E-05	3.0000000E-05	9.9999999E-05	9.9999999E-03	1.0000000E 00
K	2.0943951E 06	6.2831852E 05	2.0943951E 05	6.2831852E 04	6.2831852E 02	6.2831852E 00
OMEGA-0	6.2784938E 16	1.8835481E 16	6.2784938E 15	1.8835481E 15	1.8835481E 13	1.8835481E 11
EPSILON	9.9999918E-01	9.9999102E-01	9.9991926E-01	9.9910299E-01		
V-EMP	2.9977612E 10	2.9977734E 10	2.9978810E 10	2.9991054E 10		
P					3.5421574E-03	3.3389011E-03
OMEGA-CP	1.8243320E 15	2.1552528E 14	7.4091725E 13	5.8003658E 13	5.6412691E 13	5.6412532E 13
OMEGA-CP/OMEGA-P	3.2339126E 01	3.8205213E 00	1.3133913E 00	1.0282052E 00	1.0000028E 00	1.0000000E 00
LAMBDA-OCP	1.0324591E-04	8.7393373E-04	2.5421842E-03	3.2472920E-03	3.3388731E-03	3.3388825E-03
OPSILON-PCP	8.7103436E 08	3.4301914E 08	3.5376194E 08	9.2315691E 08	8.9783585E 10	8.9783332E 12
OPSILON-GCP	5.2204217E 07	1.3256610E 08	1.2854043E 08	4.9257836E 07	5.0647020E 05	5.0647163E 03
DELTA	3.6142538E 11	1.0509107E 13	3.3811902E 13	3.8797057E 04	-0.	-0.
DELTA/OMEGA-CP	1.9811382E-04	4.8760438E-02	4.5635193E-01	6.6887257E-10	-0.	-0.
OMEGA-WP	1.8243891E 15	2.1552574E 14	7.4091731E 13	5.8003658E 13	5.6412691E 13	5.6412532E 13
OMEGA-WP/OMEGA-P	3.2340139E 01	3.8205295E 00	1.3133913E 00	1.0282052E 00	1.0000028E 00	1.0000000E 00
LAMBDA-OWP	1.0324267E-04	8.7393185E-04	2.5421840E-03	3.2472919E-03	3.3388730E-03	3.3388824E-03
OPSILON-PWP	8.7104164E 08	3.4301988E 08	3.5376196E 08	9.2315691E 08	8.9783585E 10	8.9783332E 12
OPSILON-GWP	5.2205357E 07	1.3256659E 08	1.2854050E 08	4.9257838E 07	5.0647020E 05	5.0647163E 03
DELTA-Q	3.6142538E 11	1.0509107E 13	3.3811902E 13	3.8797056E 04	-0.	-0.
DELTA-Q/OMEGA-WP	1.9816762E-04	4.8760334E-02	4.5635190E-01	6.6887257E-10	-0.	-0.

WITHOUT OMEGA-CP APPROXIMATELY EQUAL TO OMEGA-P

OMEGA-CP	2.9783154E 14	1.1789061E 14	7.4687490E 13	5.7968749E 13	5.6412534E 13	5.6412532E 13
OMEGA-CP/OMEGA-P	5.2793824E 00	2.0897947E 00	1.3233521E 00	1.0275863E 00	1.0000000E 00	1.0000000E 00
LAMBDA-OCP	6.3237818E-04	1.5777084E-03	2.5219058E-03	3.2492476E-03	3.3388823E-03	3.3388824E-03
OPSILON-PCP	1.4221363E 08	1.8762873E 08	3.5660650E 08	9.2260128E 08	8.9783337E 10	8.9783334E 12
OPSILON-GCP	1.2302904E 07	1.1291341E 08	1.1595671E 08	4.7028250E 07	5.0647185E 05	5.0647160E 03
DELTA	5.2968745E 12	2.0124999E 13	8.5749996E 12	9.2500000E 03	0.	0.
DELTA/OMEGA-CP	1.7783607E-02	1.7070909E-01	1.1481173E-01	1.5956874E-10	0.	0.

TABLE V. - Continued. DISPERSION AND DAMPING IN A THERMAL PLASMA

N-E= 1.0E 18
LAMBDA-I= 1.0000004E-06 E-F-O= 3.6457448E-03 T-E-O= 4.2307012E 01 OMEGA-P= 5.6412532E 13 LAMBDA-OP= 3.3388825E-03

T-E= 1.0E 06
P-E= 1.3624228E 02 LAMBDA-S= 6.9014317E-06 DELTA-Q/DELTA ARG= 2.1542406E-04 DELTA-Q/DELTA= 1.0000000E 00

LAMBDA-W	1.0000000E-05	3.0000000E-05	9.9999999E-05	3.0000000E-04	9.9999999E-03	1.0000000E 00
K	6.2831852E 05	2.0943951E 05	6.2831852E 04	2.0943951E 04	6.2831852E 02	6.2831852E 00
OMEGA-O	1.8835481E 16	6.2784938E 15	1.8835481E 15	6.2784938E 14	1.8835481E 13	1.8835481E 11
EPSILON	9.9999102E-01	9.9991926E-01	9.9910299E-01	9.9192690E-01		
V-EMP	2.9977734E 10	2.9978810E 10	2.9991054E 10	3.0099343E 10		
P					3.5421574E-03	3.3389011E-03
OMEGA-CP	1.6475401E 15	2.3320448E 14	7.2323806E 13	5.8180451E 13	5.6414122E 13	5.6412532E 13
OMEGA-CP/OMEGA-P	2.9205214E 01	4.1339126E 00	1.2820521E 00	1.0313391E 00	1.0000282E 00	1.0000000E 00
LAMBDA-OCP	1.1432488E-04	8.0768095E-04	2.6043266E-03	3.2374244E-03	3.3387884E-03	3.3388825E-03
UPSILON-PCP	2.6221415E 09	1.1134693E 09	1.1510691E 09	2.7779119E 09	8.9785863E 10	8.9783332E 12
UPSILON-GCP	1.7341822E 08	4.0838763E 08	3.9504762E 08	1.6369386E 08	5.0645736E 06	5.0647164E 04
DELTA	4.2218233E 11	9.2146283E 12	3.0354519E 13	4.7313738E 05	-0.	-0.
DELTA/OMEGA-CP	2.5625012E-04	3.9513085E-02	4.1970300E-01	8.1322398E-09	-0.	-0.
OMEGA-QP	1.6475405E 15	2.3320448E 14	7.2323806E 13	5.8180451E 13	5.6414122E 13	5.6412532E 13
OMEGA-QP/OMEGA-P	2.9205222E 01	4.1339127E 00	1.2820521E 00	1.0313391E 00	1.0000282E 00	1.0000000E 00
LAMBDA-OQP	1.1432484E-04	8.0768093E-04	2.6043266E-03	3.2374244E-03	3.3387883E-03	3.3388824E-03
UPSILON-PQP	2.6221422E 09	1.1134694E 09	1.1510691E 09	2.7779119E 09	8.9785863E 10	8.9783332E 12
UPSILON-GQP	1.7341827E 08	4.0838765E 08	3.9504762E 08	1.6369386E 08	5.0645736E 06	5.0647164E 04
DELTA-Q	4.2218233E 11	9.2146283E 12	3.0354519E 13	4.7313738E 05	-0.	-0.
DELTA-Q/OMEGA-QP	2.5625004E-04	3.9513085E-02	4.1970300E-01	8.1322398E-09	-0.	-0.

WITHOUT OMEGA-CP APPROXIMATELY EQUAL TO OMEGA-P

OMEGA-CP	2.8461912E 14	1.2195312E 14	7.2874991E 13	5.8124998E 13	5.6412534E 13	5.6412532E 13
OMEGA-CP/OMEGA-P	5.0453172E 00	2.1618090E 00	1.2918227E 00	1.0303561E 00	1.0000000E 00	1.0000000E 00
LAMBDA-OCP	6.6177850E-04	1.5444854E-03	2.5846290E-03	3.2405130E-03	3.3388823E-03	3.3388824E-03
UPSILON-PCP	4.5298540E 08	5.8228326E 08	1.1598415E 09	2.7752643E 09	8.9783337E 10	8.9783334E 12
UPSILON-GCP	3.8904251E 08	3.8102401E 08	3.8102729E 08	1.5564710E 08	5.0647473E 06	5.0647162E 04
DELTA	5.6093746E 12	1.8906249E 13	7.4874995E 12	1.1500000E 05	0.	0.
DELTA/OMEGA-CP	1.9708355E-02	1.5502882E-01	1.0274443E-01	1.9784946E-09	0.	0.

N-E= 1.0E 18
LAMBDA-I= 1.0000004E-06 E-F-O= 3.6457448E-03 T-E-O= 4.2307012E 01 OMEGA-P= 5.6412532E 13 LAMBDA-OP= 3.3388825E-03

T-E= 1.0E 07
P-E= 1.3624228E 03 LAMBDA-S= 2.1824244E-05 DELTA-Q/DELTA ARG= 2.1542406E-05 DELTA-Q/DELTA= 1.0000000E 00

LAMBDA-W	3.0000000E-05	9.9999999E-05	3.0000000E-04	9.9999999E-04	9.9999999E-03	1.0000000E 00
K	2.0943951E 05	6.2831852E 04	2.0943951E 04	6.2831853E 03	6.2831852E 02	6.2831852E 00
OMEGA-O	6.2784938E 15	1.8835481E 15	6.2784938E 14	1.8835482E 14	1.8835481E 13	1.8835481E 11
EPSILON	9.9991926E-01	9.9910299E-01	9.9192690E-01	9.1029890E-01		
V-EMP	2.9978810E 10	2.9991054E 10	3.0099343E 10	3.1419903E 10		
P					3.5421574E-03	3.3389011E-03
OMEGA-CP	1.8243320E 15	2.1552528E 14	7.4091727E 13	5.8003658E 13	5.6428443E 13	5.6412532E 13
OMEGA-CP/OMEGA-P	3.2339127E 01	3.8205214E 00	1.3133913E 00	1.0282052E 00	1.0002820E 00	1.0000000E 00
LAMBDA-OCP	1.0324591E-04	8.7393371E-04	2.5421841E-03	3.2472920E-03	3.3379410E-03	3.3388824E-03
UPSILON-PCP	8.7105438E 09	3.4301915E 09	3.5376194E 09	2.2315688E 09	8.9808656E 10	8.9783334E 12
UPSILON-GCP	5.2204216E 08	1.3256610E 09	1.2654043E 09	4.9257836E 08	5.0632882E 07	5.0647162E 05
DELTA	3.6142537E 11	1.0509107E 13	3.3811904E 13	3.8797083E 04	-0.	-0.
DELTA/OMEGA-CP	1.9811381E-04	4.8760436E-02	4.5635195E-01	6.6887303E-10	-0.	-0.
OMEGA-QP	1.8243320E 15	2.1552528E 14	7.4091727E 13	5.8003658E 13	5.6428443E 13	5.6412532E 13
OMEGA-QP/OMEGA-P	3.2339127E 01	3.8205214E 00	1.3133913E 00	1.0282052E 00	1.0002820E 00	1.0000000E 00
LAMBDA-OQP	1.0324591E-04	8.7393370E-04	2.5421841E-03	3.2472919E-03	3.3379409E-03	3.3388824E-03
UPSILON-PQP	8.7105438E 09	3.4301915E 09	3.5376194E 09	2.2315688E 09	8.9808656E 10	8.9783334E 12
UPSILON-GQP	5.2204216E 08	1.3256610E 09	1.2654043E 09	4.9257836E 08	5.0632882E 07	5.0647162E 05
DELTA-Q	3.6142537E 11	1.0509107E 13	3.3811904E 13	3.8797083E 04	-0.	-0.
DELTA-Q/OMEGA-QP	1.9811381E-04	4.8760436E-02	4.5635195E-01	6.6887303E-10	-0.	-0.

WITHOUT OMEGA-CP APPROXIMATELY EQUAL TO OMEGA-P

OMEGA-CP	2.9785154E 14	1.1789061E 14	7.4687490E 13	5.7968748E 13	5.6412534E 13	5.6412532E 13
OMEGA-CP/OMEGA-P	5.2794824E 00	2.0897947E 00	1.3239521E 00	1.0275863E 00	1.0000000E 00	1.0000000E 00
LAMBDA-OCP	6.3237818E-04	1.5977084E-03	2.5219058E-03	3.2492476E-03	3.3388823E-03	3.3388824E-03
UPSILON-PCP	1.4221363E 09	1.8762873E 09	3.5660650E 09	9.2260126E 09	8.9783337E 10	8.9783334E 12
UPSILON-GCP	1.2302905E 09	1.1929135E 09	1.1595670E 09	4.7028250E 08	5.0650322E 07	5.0647161E 05
DELTA	5.2968745E 12	2.0124999E 13	8.5743996E 12	2.2500000E 03	0.	0.
DELTA/OMEGA-CP	1.7783607E-02	1.7070909E-01	1.1481173E-01	1.5956874E-10	0.	0.

TABLE V. - Continued. DISPERSION AND DAMPING IN A THERMAL PLASMA

N-E=10.0E 20
LAMBDA-I= 1.0000005E-07 E-F-0= 3.6457442E-01 T-E-0= 4.2307006E 03 OMEGA-P= 1.7839209E 15 LAMBDA-DP= 1.0558473E-04

T-E= 1.0E 02
P-E= 1.3624228E 01 LAMBDA-S= 2.1824244E-09 DELTA-Q/DELTA ARG= 6.8123069E 01 DELTA-Q/DELTA= 2.8258498E 27

LAMBDA-W	3.0000000E-09	9.9999999E-09	3.0000000E-08	9.9999999E-08	1.0000000E-06	9.9999999E-05
K	2.0943950E 09	6.2831853E 08	2.0943951E 08	6.2831852E 07	6.2831852E 06	6.2831852E 04
OMEGA-D	6.2784937E 19	1.8835481E 19	6.2784937E 18	1.8835481E 18	1.8835481E 17	1.8835481E 15
EPSILON	9.9999999E-01	9.9999998E-01	9.9999992E-01	9.9999909E-01	9.9991030E-01	1.0298906E-01
V-EMP	2.9977600E 10	2.9977600E 10	2.9977601E 10	2.9977613E 10	2.9978944E 10	9.3411705E 10
P						
OMEGA-CP	5.7690442E 16	6.8155079E 15	2.3429861E 15	1.8342367E 15	1.7844240E 15	1.7839209E 15
OMEGA-CP/OMEGA-P	3.2339126E 01	3.8205214E 00	1.3133913E 00	1.0282052E 00	1.0002820E 00	1.0000000E 00
LAMBDA-DCP	3.2649224E-06	2.7636211E-05	8.0390922E-05	1.0268839E-04	1.0555496E-04	1.0558473E-04
UPSILON-PCP	2.7545157E 07	1.0847218E 07	1.1186935E 07	2.9192784E 07	2.8399991E 08	2.8391983E 10
UPSILON-GCP	1.6508423E 06	4.1921082E 06	4.0648053E 06	1.5576695E 06	1.6011523E 05	1.6016039E 03
DELTA	1.1429274E 13	3.3232714E 14	1.0692263E 15	1.2268706E 06	-0.	-0.
DELTA/OMEGA-CP	1.9811382E-04	4.8760436E-02	4.5635195E-01	6.6887257E-10	-0.	-0.
OMEGA-QP	1.8069208E 21	1.4642407E 19	1.8302931E 17	3.2977959E 15	1.7845704E 15	1.7839209E 15
OMEGA-QP/OMEGA-P	1.0128929E 06	8.2079915E 03	1.0259945E 02	1.8486223E 00	1.0003641E 00	1.0000000E 00
LAMBDA-DQP	1.0424076E-10	1.2863650E-08	1.0290965E-06	5.7115363E-05	1.0554631E-04	1.0558473E-04
UPSILON-PQP	8.6274115E 11	2.3304115E 10	8.7390057E 08	5.2486053E 07	2.8402320E 08	2.8391983E 10
UPSILON-GQP	3.4069819E 06	1.1353458E 07	3.3686273E 07	5.1267734E 07	2.5324126E 05	1.6016971E 03
DELTA-Q	1.7014118E 38	1.7014118E 38	1.7014118E 38	3.4669521E 33	-0.	-0.
DELTA-Q/OMEGA-QP	1.7874282E 19	6.4136078E 22	1.6508137E 25	1.0512937E 18	-0.	-0.

WITHOUT OMEGA-CP APPROXIMATELY EQUAL TO OMEGA-P

OMEGA-CP	9.4179680E 15	3.7285138E 15	2.3609360E 15	1.8320312E 15	1.7839220E 15	1.7839210E 15
OMEGA-CP/OMEGA-P	5.2793642E 00	2.0900668E 00	1.3234533E 00	1.0269689E 00	1.0000006E 00	1.0000000E 00
LAMBDA-DCP	1.9999517E-05	5.0517398E-05	7.9779719E-05	1.0281201E-04	1.0558467E-04	1.0558473E-04
UPSILON-PCP	4.4967485E 06	5.9341140E 06	1.1272639E 07	2.9157682E 07	2.8392000E 08	2.8391984E 10
UPSILON-GCP	3.8912888E 06	3.7711325E 06	3.6695128E 06	1.4897677E 06	1.6017010E 05	1.6016037E 03
DELTA	1.6749998E 14	6.3593746E 14	2.7187498E 14	3.0234375E 05	0.	0.
DELTA/OMEGA-CP	1.7785151E-02	1.7056058E-01	1.1515559E-01	1.6503198E-10	0.	0.

N-E=10.0E 20
LAMBDA-I= 1.0000005E-07 E-F-0= 3.6457442E-01 T-E-0= 4.2307006E 03 OMEGA-P= 1.7839209E 15 LAMBDA-DP= 1.0558473E-04

T-E= 1.0E 03
P-E= 1.3624228E 02 LAMBDA-S= 6.9014313E-09 DELTA-Q/DELTA ARG= 6.8123071E 00 DELTA-Q/DELTA= 6.6714866E 01

LAMBDA-W	9.9999999E-09	3.0000000E-08	9.9999999E-08	3.0000000E-07	1.0000000E-06	9.9999999E-05
K	6.2831853E 08	2.0943951E 08	6.2831852E 07	2.0943951E 07	6.2831852E 06	6.2831852E 04
OMEGA-D	1.8835481E 19	6.2784937E 18	1.8835481E 18	6.2784938E 17	1.8835481E 17	1.8835481E 15
EPSILON	9.9999998E-01	9.9999992E-01	9.9999903E-01	9.9999192E-01	9.9991030E-01	1.0298906E-01
V-EMP	2.9977600E 10	2.9977601E 10	2.9977613E 10	2.9977721E 10	2.9978944E 10	9.3411705E 10
P						
OMEGA-CP	5.2099791E 16	7.3745731E 15	2.2870795E 15	1.8398274E 15	1.7889524E 15	1.7839214E 15
OMEGA-CP/OMEGA-P	2.9205214E 01	4.1339126E 00	1.2820521E 00	1.0313391E 00	1.0028205E 00	1.0000003E 00
LAMBDA-DCP	3.6152700E-06	2.5541115E-05	8.2356039E-05	1.0237635E-04	1.0528777E-04	1.0558471E-04
UPSILON-PCP	8.2919393E 07	3.5210993E 07	3.6400001E 07	8.7845287E 07	2.8472062E 08	2.8391990E 10
UPSILON-GCP	5.4839656E 06	1.2914350E 07	1.2492502E 07	5.1764540E 06	1.5970993E 06	1.6016035E 04
DELTA	1.3350578E 13	2.9139214E 14	9.5989417E 14	1.4961918E 07	-0.	-0.
DELTA/OMEGA-CP	2.5625012E-04	3.9513085E-02	4.1970300E-01	8.1322398E-09	-0.	-0.
OMEGA-QP	1.4687692E 19	1.8806089E 17	3.7506388E 15	1.8578960E 15	1.7890988E 15	1.7839214E 15
OMEGA-QP/OMEGA-P	8.2333764E 03	1.0541997E 02	2.1024692E 00	1.0414677E 00	1.0029025E 00	1.0000003E 00
LAMBDA-DQP	1.2823990E-08	1.0015629E-06	5.0219395E-05	1.0138071E-04	1.0527916E-04	1.0558470E-04
UPSILON-PQP	2.3376188E 10	8.9792463E 08	5.9693270E 07	8.8708001E 07	2.8474392E 08	2.8391990E 10
UPSILON-GQP	1.1335961E 07	3.3240773E 07	5.1933751E 07	8.4395645E 06	1.6898720E 06	1.6016128E 04
DELTA-Q	8.9068201E 14	1.9440187E 16	6.4039210E 16	9.9818234E 08	-0.	-0.
DELTA-Q/OMEGA-QP	6.0641385E-05	1.0337177E-01	1.7074214E 01	5.3726491E-07	-0.	-0.

WITHOUT OMEGA-CP APPROXIMATELY EQUAL TO OMEGA-P

OMEGA-CP	9.0000000E 15	3.8574206E 15	2.3046843E 15	1.8359375E 15	1.7872217E 15	1.7839210E 15
OMEGA-CP/OMEGA-P	5.0450668E 00	2.1623272E 00	1.2919206E 00	1.0291586E 00	1.0018503E 00	1.0000000E 00
LAMBDA-DCP	2.0928313E-05	4.8029213E-05	8.1726949E-05	1.0259326E-04	1.0538973E-04	1.0558473E-04
UPSILON-PCP	1.4323945E 07	1.8417827E 07	3.6680189E 07	8.7653558E 07	2.8444518E 08	2.8391984E 10
UPSILON-GCP	1.2303835E 07	1.2041981E 07	6.9147262E 06	4.9386289E 06	1.5937515E 06	1.6016037E 04
DELTA	1.7749998E 14	5.9843746E 14	2.3671874E 14	3.8437500E 06	0.	0.
DELTA/OMEGA-CP	1.9722220E-02	1.5513928E-01	1.0271200E-01	2.0936170E-09	0.	0.

TABLE V. - Continued. DISPERSION AND DAMPING IN A THERMAL PLASMA

T-E=10.0E 20
LAMBDA-I= 1.0000005E-07 E-F-0= 3.6457442E-01 T-E-0= 4.2307006E 03 OMEGA-P= 1.7839209E 15 LAMBDA-DP= 1.0558473E-04

T-E= 1.0E 04
P-E= 1.3624228E 04 LAMBDA-S= 2.1824244E-08 DELTA-Q/DELTA ARG= 6.8123070E-01 DELTA-Q/DELTA= 1.0791606E 00

LAMBDA-W	3.0000000E-08	9.9999999E-08	3.0000000E-07	1.0000000E-06	9.9999999E-05	9.9999999E-03
K	2.0943951E 08	6.2831852E 07	2.0943951E 07	6.2831852E 06	6.2831852E 04	6.2831852E 02
OMEGA-O	6.2784938E 18	1.8835481E 18	6.2784938E 17	1.8835481E 17	1.8835481E 15	1.8835481E 13
EPSILON	9.9999992E-01	9.9999909E-01	9.9999192E-01	9.9991030E-01	1.0298906E-01	
V-EMP	2.9977601E 10	2.9977613E 10	2.9977721E 10	2.9978944E 10	9.3411705E 10	
P						1.0559062E-04
OMEGA-CP	5.7690442E 16	6.8155079E 15	2.3429860E 15	1.8342367E 15	1.7839259E 15	1.7839209E 15
OMEGA-CP/OMEGA-P	3.2335126E 01	3.8205214E 00	1.3133913E 00	1.0282052E 00	1.0000028E 00	1.0000000E 00
LAMBDA-DCP	3.2649224E-06	2.7636211E-05	8.0390924E-05	1.0268839E-04	1.0558444E-04	1.0558473E-04
OPSILON-PCP	2.7545158E 08	1.0847218E 08	1.1186934E 08	2.9192784E 08	2.8392062E 10	2.8391982E 12
OPSILON-GCP	1.6508423E 07	4.1921082E 07	4.0648053E 07	1.5576695E 07	1.6015994E 05	1.6016039E 03
DELTA	1.1429274E 13	3.3232714E 14	1.0692262E 15	1.2268706E 06	-0.	-0.
DELTA/OMEGA-CP	1.9811382E-04	4.8760436E-02	4.5635193E-01	6.6887257E-10	-0.	-0.
OMEGA-QP	2.3837676E 17	8.2790672E 15	2.3610547E 15	1.8343831E 15	1.7839259E 15	1.7839209E 15
OMEGA-QP/OMEGA-P	1.3362518E 02	4.6409385E 00	1.3235199E 00	1.0282872E 00	1.0000028E 00	1.0000000E 00
LAMBDA-DQP	7.9015594E-07	2.2750729E-05	7.9775709E-05	1.0268019E-04	1.0558444E-04	1.0558473E-04
OPSILON-PQP	1.1381652E 09	1.3176545E 08	1.1273206E 08	2.9195113E 08	2.8392062E 10	2.8391982E 12
OPSILON-GQP	2.9820146E 07	5.4586687E 07	4.2944313E 07	1.5666063E 07	1.6016003E 05	1.6016039E 03
DELTA-Q	1.2334022E 13	3.5863434E 14	1.1538667E 15	1.3239904E 06	-0.	-0.
DELTA-Q/OMEGA-QP	5.1741713E-05	4.3318206E-02	4.8870818E-01	7.2176331E-10	-0.	-0.

WITHOUT OMEGA-CP APPROXIMATELY EQUAL TO OMEGA-P

OMEGA-CP	9.4179682E 15	3.7285138E 15	2.3609360E 15	1.8320312E 15	1.7839220E 15	1.7839210E 15
OMEGA-CP/OMEGA-P	5.2793642E 00	2.0900668E 00	1.3234533E 00	1.0269689E 00	1.0000006E 00	1.0000000E 00
LAMBDA-DCP	1.9999517E-05	5.0517398E-05	7.9779719E-05	1.0281201E-04	1.0558467E-04	1.0558473E-04
OPSILON-PCP	4.4967486E 07	5.9341140E 07	1.1272639E 08	2.9157687E 08	2.8392000E 10	2.8391984E 12
OPSILON-GCP	3.8912887E 07	4.0184941E 07	2.1804944E 07	1.4897676E 07	1.6016019E 05	1.6016037E 03
DELTA	1.6749998E 14	6.3593746E 14	2.7187498E 14	3.0234375E 05	0.	0.
DELTA/OMEGA-CP	1.7785151E-02	1.7056058E-01	1.1515559E-01	1.6503198E-10	0.	0.

T-E=10.0E 20
LAMBDA-I= 1.0000005E-07 E-F-0= 3.6457442E-01 T-E-0= 4.2307006E 03 OMEGA-P= 1.7839209E 15 LAMBDA-DP= 1.0558473E-04

T-E= 1.0E 05
P-E= 1.3624228E 04 LAMBDA-S= 6.9014319E-08 DELTA-Q/DELTA ARG= 6.8123070E-02 DELTA-Q/DELTA= 1.0007733E 00

LAMBDA-W	9.9999999E-08	3.0000000E-07	1.0000000E-06	3.0000000E-06	9.9999999E-05	9.9999999E-03
K	6.2831852E 07	2.0943951E 07	6.2831852E 06	2.0943951E 06	6.2831852E 04	6.2831852E 02
OMEGA-O	1.8835481E 18	6.2784938E 17	1.8835481E 17	6.2784938E 16	1.8835481E 15	1.8835481E 13
EPSILON	9.9999909E-01	9.9999192E-01	9.9991030E-01	9.9919268E-01	1.0298906E-01	
V-EMP	2.9977613E 10	2.9977721E 10	2.9978944E 10	2.9989707E 10	9.3411705E 10	
P						1.0559062E-04
OMEGA-CP	5.2099789E 16	7.3745729E 15	2.2870795E 15	1.8398274E 15	1.7839712E 15	1.7839209E 15
OMEGA-CP/OMEGA-P	2.9205213E 01	4.1339126E 00	1.2820521E 00	1.0313391E 00	1.0000282E 00	1.0000000E 00
LAMBDA-DCP	3.6152701E-06	2.5541115E-05	8.2356039E-05	1.0237635E-04	1.0558176E-04	1.0558473E-04
OPSILON-PCP	8.2919390E 08	3.5210922E 08	3.6400002E 08	8.7845289E 08	2.8392783E 10	2.8391982E 12
OPSILON-GCP	5.4839658E 07	1.2914350E 08	1.2492502E 08	5.1764540E 07	1.6015587E 06	1.6016039E 04
DELTA	1.3350578E 13	2.9139214E 14	9.5989412E 14	1.4961918E 07	-0.	-0.
DELTA/OMEGA-CP	2.5625014E-04	3.9513087E-02	4.1970298E-01	8.1322398E-09	-0.	-0.
OMEGA-QP	5.3563348E 16	7.3926415E 15	2.2872259E 15	1.8398292E 15	1.7839712E 15	1.7839209E 15
OMEGA-QP/OMEGA-P	3.0025630E 01	4.1440411E 00	1.2821342E 00	1.0313401E 00	1.0000282E 00	1.0000000E 00
LAMBDA-DQP	3.5164869E-06	2.5478688E-05	8.2350768E-05	1.0237625E-04	1.0558176E-04	1.0558473E-04
OPSILON-PQP	8.5249717E 08	3.5297204E 08	3.6402331E 08	8.7845373E 08	2.8392783E 10	2.8391982E 12
OPSILON-GQP	5.6444342E 07	1.2966059E 08	1.2498969E 08	5.1767836E 07	1.6015588E 06	1.6016039E 04
DELTA-Q	1.3360902E 13	2.9161748E 14	9.6063641E 14	1.4973488E 07	-0.	-0.
DELTA-Q/OMEGA-QP	2.4444113E-04	3.9446993E-02	4.2000067E-01	8.1385207E-09	-0.	-0.

WITHOUT OMEGA-CP APPROXIMATELY EQUAL TO OMEGA-P

OMEGA-CP	9.0000000E 15	3.8574206E 15	2.3046843E 15	1.8359375E 15	1.7839220E 15	1.7839210E 15
OMEGA-CP/OMEGA-P	5.0450668E 00	2.1623272E 00	1.2919206E 00	1.0291586E 00	1.0000006E 00	1.0000000E 00
LAMBDA-DCP	2.0328313E-05	4.8829213E-05	8.1726949E-05	1.0259326E-04	1.0558467E-04	1.0558473E-04
OPSILON-PCP	1.4323345E 08	1.8417827E 08	3.6680189E 08	8.7659557E 08	2.8392000E 10	2.8391984E 12
OPSILON-GCP	1.2303835E 08	1.2646839E 08	6.9147260E 07	4.9386289E 07	1.6016109E 06	1.6016036E 04
DELTA	1.7749998E 14	5.3843746E 14	2.3671874E 14	3.8437500E 06	0.	0.
DELTA/OMEGA-CP	1.9722220E-02	1.9513928E-01	1.0271200E-01	2.0936170E-09	0.	0.

TABLE V. - Continued. DISPERSION AND DAMPING IN A THERMAL PLASMA

N-E=10.0E 20
LAMBDA-I= 1.0000005E-07 E-F-0= 3.6457442E-01 T-E-0= 4.2307006E 03 OMEGA-P= 1.7839209E 15 LAMBDA-OP= 1.0558473E-04

T-E= 1.0E 06
P-E= 1.3624227E 05 LAMBDA-S= 2.1624244E-07 DELTA-Q/DELTA ARG= 6.8123070E-03 DELTA-Q/DELTA= 1.0000083E 00

LAMBDA-W	3.0000000E-07	1.0000000E-06	3.0000000E-06	1.0000000E-05	9.9999999E-05	9.9999999E-03
K	2.0943951E 07	6.2831852E 06	2.0943951E 06	6.2831852E 05	6.2831852E 04	6.2831852E 02
OMEGA-O	6.2784938E 17	1.8835481E 17	6.2784938E 16	1.8835481E 16	1.8835481E 15	1.8835481E 13
EPSILON	9.9999192E-01	9.9991030E-01	9.9919268E-01	9.9102988E-01	1.0298906E-01	
V-EMP	2.9977721E 10	2.9978944E 10	2.9989707E 10	3.0112962E 10	9.3411705E 10	
P						1.0559062E-04
OMEGA-CP	5.7690442E 16	6.8155078E 15	2.3429860E 15	1.8342367E 15	1.7844240E 15	1.7839209E 15
OMEGA-CP/OMEGA-P	3.2339126E 01	3.8205213E 00	1.3133913E 00	1.0282052E 00	1.0002820E 00	1.0000000E 00
LAMBDA-OCP	3.2649224E-06	2.7636212E-05	8.0390924E-05	1.0268839E-04	1.0555496E-04	1.0558473E-04
UPSILON-PCP	2.7545157E 09	1.0847218E 09	1.1186934E 09	2.9192784E 09	2.8399990E 10	2.8391983E 12
UPSILON-GCP	1.6508423E 08	4.1921082E 08	4.0648052E 08	1.5576695E 08	1.6011523E 07	1.6016038E 05
DELTA	1.1429274E 13	3.3232715E 14	1.0692262E 15	1.2268698E 06	-0.	-0.
DELTA/OMEGA-CP	1.9811382E-04	4.8760438E-02	4.5635193E-01	6.6887211E-10	-0.	-0.
OMEGA-QP	5.7708511E 16	6.8156540E 15	2.3429879E 15	1.8342367E 15	1.7844240E 15	1.7839209E 15
OMEGA-QP/OMEGA-P	3.2349254E 01	3.8206033E 00	1.3133923E 00	1.0282052E 00	1.0002820E 00	1.0000000E 00
LAMBDA-OQP	3.2639000E-06	2.7635618E-05	8.0390860E-05	1.0268839E-04	1.0555496E-04	1.0558473E-04
UPSILON-PQP	2.7553785E 09	1.0847450E 09	1.1186943E 09	2.9192784E 09	2.8399990E 10	2.8391983E 12
UPSILON-GQP	1.6513921E 08	4.1922621E 08	4.0648283E 08	1.5576704E 08	1.6011523E 07	1.6016038E 05
DELTA-Q	1.1429369E 13	3.3232991E 14	1.0692351E 15	1.2268800E 06	-0.	-0.
DELTA-Q/OMEGA-QP	1.9805344E-04	4.8759798E-02	4.5635538E-01	6.6887768E-10	-0.	-0.

WITHOUT OMEGA-CP APPROXIMATELY EQUAL TO OMEGA-P

OMEGA-CP	9.4179682E 15	3.7285138E 15	2.3609360E 15	1.8320312E 15	1.7839220E 15	1.7839210E 15
OMEGA-CP/OMEGA-P	5.2793642E 00	2.0900668E 00	1.3234533E 00	1.0269689E 00	1.0000006E 00	1.0000000E 00
LAMBDA-OCP	1.9999517E-05	5.0517398E-05	7.9779719E-05	1.0281201E-04	1.0558467E-04	1.0558473E-04
UPSILON-PCP	4.4967486E 08	5.9341140E 08	1.1272639E 09	2.9157682E 09	2.8392000E 10	2.8391984E 12
UPSILON-GCP	3.8912886E 08	4.0384940E 08	2.1604945E 08	1.4897677E 08	1.6017011E 07	1.6016036E 05
DELTA	1.6749998E 14	6.3593746E 14	2.7187498E 14	3.0234375E 05	0.	0.
DELTA/OMEGA-CP	1.7785151E-02	1.7056058E-01	1.1515559E-01	1.6503198E-10	0.	0.

N-E=10.0E 20
LAMBDA-I= 1.0000005E-07 E-F-0= 3.6457442E-01 T-E-0= 4.2307006E 03 OMEGA-P= 1.7839209E 15 LAMBDA-OP= 1.0558473E-04

T-E= 1.0E 07
P-E= 1.3624227E 06 LAMBDA-S= 6.9014319E-07 DELTA-Q/DELTA ARG= 6.8123070E-04 DELTA-Q/DELTA= 1.0000008E 00

LAMBDA-W	1.0000000E-06	3.0000000E-06	1.0000000E-05	3.0000000E-05	9.9999999E-05	9.9999999E-03
K	6.2831852E 06	2.0943951E 06	6.2831852E 05	2.0943951E 05	6.2831852E 04	6.2831852E 02
OMEGA-O	1.8835481E 17	6.2784938E 16	1.8835481E 16	6.2784938E 15	1.8835481E 15	1.8835481E 13
EPSILON	9.9991030E-01	9.9919268E-01	9.9102988E-01	9.1926901E-01	1.0298906E-01	
V-EMP	2.9978944E 10	2.9989707E 10	3.0112962E 10	3.1266232E 10	9.3411705E 10	
P						1.0559062E-04
OMEGA-CP	5.2099791E 16	7.3745731E 15	2.2870795E 15	1.8398274E 15	1.7889524E 15	1.7839214E 15
OMEGA-CP/OMEGA-P	2.9205214E 01	4.1339126E 00	1.2820521E 00	1.0313391E 00	1.0028205E 00	1.0000003E 00
LAMBDA-OCP	3.6152700E-06	2.5541115E-05	8.2356039E-05	1.0237635E-04	1.0528777E-04	1.0558471E-04
UPSILON-PCP	8.2919393E 09	3.5210993E 09	3.6400002E 09	8.7845287E 09	2.8472062E 10	2.8391990E 12
UPSILON-GCP	5.4839658E 08	1.2914331E 09	1.2492502E 09	5.1764542E 08	1.5970993E 08	1.6016035E 06
DELTA	1.3350578E 13	2.9139214E 14	9.5989417E 14	1.4961931E 07	-0.	-0.
DELTA/OMEGA-CP	2.5625012E-04	3.9513085E-02	4.1970300E-01	8.1322471E-09	-0.	-0.
OMEGA-QP	5.2099937E 16	7.3745747E 15	2.2870795E 15	1.8398274E 15	1.7889524E 15	1.7839214E 15
OMEGA-QP/OMEGA-P	2.9205296E 01	4.1339136E 00	1.2820521E 00	1.0313391E 00	1.0028205E 00	1.0000003E 00
LAMBDA-OQP	3.6152598E-06	2.5541108E-05	8.2356038E-05	1.0237635E-04	1.0528777E-04	1.0558470E-04
UPSILON-PQP	8.2919625E 09	3.5211001E 09	3.6400002E 09	8.7845287E 09	2.8472062E 10	2.8391990E 12
UPSILON-GQP	5.4839823E 08	1.2914356E 09	1.2492503E 09	5.1764542E 08	1.5970993E 08	1.6016035E 06
DELTA-Q	1.3350577E 13	2.9139213E 14	9.5989414E 14	1.4961931E 07	-0.	-0.
DELTA-Q/OMEGA-QP	2.5624940E-04	3.9513076E-02	4.1970300E-01	8.1322471E-09	-0.	-0.

WITHOUT OMEGA-CP APPROXIMATELY EQUAL TO OMEGA-P

OMEGA-CP	9.0000000E 15	3.8574206E 15	2.3046843E 15	1.8359375E 15	1.7872217E 15	1.7839210E 15
OMEGA-CP/OMEGA-P	5.0450668E 00	2.1623272E 00	1.2919206E 00	1.0291586E 00	1.0018503E 00	1.0000000E 00
LAMBDA-OCP	2.0928313E-05	4.8829213E-05	8.1726949E-05	1.0253326E-04	1.0538973E-04	1.0558473E-04
UPSILON-PCP	1.4323945E 09	1.8417827E 09	3.6680189E 09	8.7659957E 09	2.8444517E 10	2.8391984E 12
UPSILON-GCP	1.2303835E 07	1.2646839E 09	6.9147265E 08	4.9386290E 08	1.5937515E 08	1.6016038E 06
DELTA	1.7749998E 14	5.9843746E 14	2.3671874E 14	3.8437500E 06	0.	0.
DELTA/OMEGA-CP	1.9722220E-02	1.5513928E-01	1.0271200E-01	2.0936170E-09	0.	0.

TABLE V. - Continued. DISPERSION AND DAMPING IN A THERMAL PLASMA

N-E= 1.0E 24
LAMBDA-I= 1.0000004E-08 E-F-0= 3.6457444E 01 T-E-0= 4.2307007E 05 OMEGA-P= 5.6412531E 16 LAMBDA-OP= 3.3388825E-06

T-L= 1.0E 04
P-E= 1.3624227E 06 LAMBDA-S= 6.9014319E-10 DELTA-Q/DELTA ARG= 2.1542406E 01 DELTA-Q/DELTA= 5.2653091E 07

LAMBDA-W	9.9999998E-10	3.0000000E-09	9.9999999E-09	3.0000000E-08	1.0000000E-06	9.9999999E-05
K	6.2831852E 09	2.0943950E 09	6.2831853E 08	2.0943951E 08	6.2831852E 06	6.2831852E 04
OMEGA-0	1.8835481E 20	6.2784937E 19	1.8835481E 19	6.2784937E 18	1.8835481E 17	1.8835481E 15
EPSILON	9.9999989E-01	9.9999918E-01	9.9999102E-01	9.9991926E-01	9.1029890E-01	
V-EMP	2.9977601E 10	2.9977612E 10	2.9977734E 10	2.9978810E 10	3.1419903E 10	
P						3.3407451E-06
OMEGA-CP	1.6475400E 18	2.3320448E 17	7.2323806E 16	5.8180450E 16	5.6414121E 16	5.6412531E 16
OMEGA-CP/OMEGA-P	2.9205213E 01	4.1339126E 00	1.2820521E 00	1.0313391E 00	1.0000282E 00	1.0000000E 00
LAMBDA-OCP	1.1432488E-07	8.0768035E-07	2.6043266E-06	3.2374245E-06	3.3387884E-06	3.3388825E-06
UPSILON-PCP	2.6221414E 08	1.1134694E 08	1.1510091E 08	2.7779119E 08	8.9785863E 09	8.9783332E 11
UPSILON-GCP	1.7341823E 07	4.0838762E 07	3.9504761E 07	1.6369385E 07	5.0645734E 05	5.0647162E 03
DELTA	4.2218235E 14	9.2146283E 15	3.0354519E 16	4.7313738E 08	-0.	-0.
DELTA/OMEGA-CP	2.5625014E-04	3.9513085E-02	4.1970300E-01	8.1322398E-09	-0.	-0.
OMEGA-QP	4.6298277E 21	5.7371233E 19	5.3514184E 17	6.3894253E 16	5.6414126E 16	5.6412531E 16
OMEGA-QP/OMEGA-P	8.2070907E 04	1.0169945E 03	9.4862227E 00	1.1326252E 00	1.0000283E 00	1.0000000E 00
LAMBDA-OQP	4.0682899E-11	3.2830880E-09	3.5197175E-07	2.9479147E-06	3.3387881E-06	3.3388824E-06
UPSILON-PQP	7.3685996E 11	2.7392746E 10	8.5170468E 08	3.0507259E 08	8.9785869E 09	8.9783332E 11
UPSILON-GQP	3.5906726E 07	1.0746806E 08	1.1593591E 08	1.1125303E 08	5.0940361E 05	5.0647191E 03
DELTA-Q	2.2229205E 22	4.8517866E 23	1.5982592E 24	2.4912145E 16	-0.	-0.
DELTA-Q/OMEGA-QP	4.8013030E 00	8.4568281E 03	2.9866086E 06	3.8989650E-01	-0.	-0.

WITHOUT OMEGA-CP APPROXIMATELY EQUAL TO OMEGA-P

OMEGA-CP	2.8460936E 17	1.2195309E 17	7.2843996E 16	5.8124999E 16	5.6412532E 16	5.6412532E 16
OMEGA-CP/OMEGA-P	5.0451442E 00	2.1618084E 00	1.2913797E 00	1.0303561E 00	1.0000000E 00	1.0000000E 00
LAMBDA-OCP	6.6180118E-07	1.5444858E-06	2.5855157E-06	3.2405130E-06	3.3388824E-06	3.3388824E-06
UPSILON-PCP	4.5296987E 07	5.8228310E 07	1.1594437E 08	2.7752643E 08	8.9783334E 09	8.9783334E 11
UPSILON-GCP	3.8906926E 07	4.0008872E 07	2.1874612E 07	1.5564710E 07	5.0647478E 05	5.0647159E 03
DELTA	5.6093746E 15	1.8906248E 16	7.5124997E 15	1.1484375E 08	0.	C.
DELTA/OMEGA-CP	1.9709030E-02	1.5502886E-01	1.0312285E-01	1.9758065E-09	0.	C.

N-E= 1.0E 24
LAMBDA-I= 1.0000004E-08 E-F-0= 3.6457444E 01 T-E-0= 4.2307007E 05 OMEGA-P= 5.6412531E 16 LAMBDA-OP= 3.3388825E-06

T-L= 1.0E 05
P-E= 1.3624228E 07 LAMBDA-S= 2.1824244E-09 DELTA-Q/DELTA ARG= 2.1542406E 00 DELTA-Q/DELTA= 1.9740945E 00

LAMBDA-W	3.0000000E-09	9.9999999E-09	3.0000000E-08	9.9999999E-08	1.0000000E-06	9.9999999E-05
K	2.0943950E 09	6.2831853E 08	2.0943951E 08	6.2831852E 07	6.2831852E 06	6.2831852E 04
OMEGA-0	6.2784937E 19	1.8835481E 19	6.2784937E 18	1.8835481E 18	1.8835481E 17	1.8835481E 15
EPSILON	9.9999918E-01	9.9999102E-01	9.9991926E-01	9.9910299E-01	9.1029890E-01	
V-EMP	2.9977612E 10	2.9977734E 10	2.9978810E 10	2.9991054E 10	3.1419903E 10	
P						3.3407451E-06
OMEGA-CP	1.8243319E 18	2.1552528E 17	7.4091726E 16	5.8003657E 16	5.6428442E 16	5.6412532E 16
OMEGA-CP/OMEGA-P	3.2339126E 01	3.8205214E 00	1.3133413E 00	1.0282052E 00	1.0002820E 00	1.0000000E 00
LAMBDA-OCP	1.0324591E-07	8.7393372E-07	2.5421842E-06	3.2472920E-06	3.3379411E-06	3.3388824E-06
UPSILON-PCP	8.7105435E 08	3.4301914E 08	3.5376194E 08	9.2315688E 08	8.9808655E 09	8.9783332E 11
UPSILON-GCP	5.2204217E 07	1.3256610E 08	1.2854043E 08	4.9257836E 07	5.0632882E 06	5.0647162E 04
DELTA	3.6142538E 14	1.0509107E 16	3.3811904E 16	3.8797056E 07	-0.	-0.
DELTA/OMEGA-CP	1.9811382E-04	4.8760436E-02	4.5635195E-01	6.6887257E-10	-0.	-0.
OMEGA-QP	5.8962359E 19	6.7834333E 17	7.9805528E 16	5.8049939E 16	5.6428446E 16	5.6412532E 16
OMEGA-QP/OMEGA-P	1.0451997E 03	1.2024692E 01	1.4146773E 00	1.0290256E 00	1.0002821E 00	1.0000000E 00
LAMBDA-OQP	3.1944924E-09	2.7766885E-07	2.3601725E-06	3.2447030E-06	3.3379408E-06	3.3388824E-06
UPSILON-PQP	2.8152453E 10	1.0796169E 09	3.8104333E 08	9.2389349E 08	8.9808661E 09	8.9783332E 11
UPSILON-GQP	1.0602169E 08	2.8714771E 08	1.9647553E 08	5.2081846E 07	5.0662333E 06	5.0647165E 04
DELTA-Q	7.1348786E 14	2.0745970E 16	6.6747892E 16	7.6589056E 07	-0.	-0.
DELTA-Q/OMEGA-QP	1.2100735E-05	3.0583289E-02	8.3638182E-01	1.3193650E-09	-0.	-0.

WITHOUT OMEGA-CP APPROXIMATELY EQUAL TO OMEGA-P

OMEGA-CP	2.9785153E 17	1.1790000E 17	7.4699999E 16	5.8000000E 16	5.6412532E 16	5.6412532E 16
OMEGA-CP/OMEGA-P	5.2798823E 00	2.0899611E 00	1.3241738E 00	1.0281403E 00	1.0000000E 00	1.0000000E 00
LAMBDA-OCP	6.3237820E-07	1.5975811E-06	2.5214835E-06	3.2474368E-06	3.3388824E-06	3.3388824E-06
UPSILON-PCP	1.4221363E 08	1.8764368E 08	3.5666623E 08	9.2309868E 08	8.9783334E 09	8.9783334E 11
UPSILON-GCP	1.2302840E 08	1.2772764E 08	6.8890672E 07	4.6954528E 07	5.0650328E 06	5.0647162E 04
DELTA	5.2968746E 15	2.0130000E 16	8.5699999E 15	8.9999999E 06	0.	C.
DELTA/OMEGA-CP	1.7783607E-02	1.7073791E-01	1.1472557E-01	1.5517241E-10	0.	0.

TABLE V. - Concluded. DISPERSION AND DAMPING IN A THERMAL PLASMA

N-E= 1.0E 24
LAMBDA-I= 1.0000004E-08 E-F-0= 3.6457444E 01 T-E-0= 4.2307007E 05 OMEGA-P= 5.6412531E 16 LAMBDA-OP= 3.3388825E-06

T-E= 1.0E 06
P-E= 1.3624228E 08 LAMBDA-S= 6.9014319E-09 DELTA-Q/DELTA ARG= 2.1542406E-01 DELTA-Q/DELTA= 1.0077525E 00

LAMBDA-W	9.9999999E-09	3.0000000E-08	9.9999999E-08	3.0000000E-07	1.0000000E-06	9.9999999E-05
K	6.2831853E 08	2.0943951E 08	6.2831852E 07	2.0943951E 07	6.2831852E 06	6.2831852E 04
OMEGA-0	1.8835481E 19	6.2784937E 18	1.8835481E 18	6.2784938E 17	1.8835481E 17	1.8835481E 15
EPSILON	9.9999102E-01	9.9991926E-01	9.9910299E-01	9.9192690E-01	9.1029890E-01	
V-EMP	2.9977734E 10	2.9978810E 10	2.9991054E 10	3.0099343E 10	3.1419903E 10	
P						3.3407451E-06
OMEGA-CP	1.6475400E 18	2.3320448E 17	7.2323806E 16	5.8180450E 16	5.6571643E 16	5.6412546E 16
OMEGA-CP/OMEGA-P	2.9205214E 01	4.1339126E 00	1.2820521E 00	1.0313391E 00	1.0028205E 00	1.0000003E 00
LAMBDA-OCP	1.1432488E-07	8.0768095E-07	2.6043266E-06	3.2374245E-06	3.3294916E-06	3.3388816E-06
UPSILON-PCP	2.6221414E 09	1.1134693E 09	1.1510691E 09	2.7779119E 09	9.0036566E 09	8.9783356E 11
UPSILON-GCP	1.7341822E 08	4.0838762E 08	3.9504761E 08	1.6369385E 08	5.0504713E 07	5.0647148E 05
DELTA	4.2218233E 14	9.2146283E 15	3.0354519E 16	4.7313738E 08	-0.	-0.
DELTA/OMEGA-CP	2.5625012E-04	3.9513085E-02	4.1970300E-01	8.1322398E-09	-0.	-0.
OMEGA-OP	2.1103581E 18	2.3891828E 17	7.2370087E 16	5.8181021E 16	5.6571647E 16	5.6412546E 16
OMEGA-OP/OMEGA-P	3.7409385E 01	4.2351987E 00	1.2828725E 00	1.0313492E 00	1.0028206E 00	1.0000003E 00
LAMBDA-OOP	8.9252536E-08	7.8836502E-07	2.6026611E-06	3.2373927E-06	3.3294914E-06	3.3388816E-06
UPSILON-POP	3.3587392E 09	1.1407508E 09	1.1518057E 09	2.7779391E 09	9.0036572E 09	8.9783356E 11
UPSILON-GOP	2.1414700E 08	4.2438725E 08	3.9709168E 08	1.6379805E 08	5.0507647E 07	5.0647148E 05
DELTA-Q	4.2545531E 14	9.2860650E 15	3.0589842E 16	4.7680539E 08	-0.	-0.
DELTA-Q/OMEGA-OP	2.0160337E-04	3.8867119E-02	4.2268628E-01	8.1952049E-09	-0.	-0.

WITHOUT OMEGA-CP APPROXIMATELY EQUAL TO OMEGA-P

OMEGA-CP	2.8460933E 17	1.2200191E 17	7.2839998E 16	5.8099999E 16	5.6612539E 16	5.6412532E 16
OMEGA-CP/OMEGA-P	5.0451437E 00	2.1626738E 00	1.2912024E 00	1.0299130E 00	1.0035454E 00	1.0000000E 00
LAMBDA-OCP	6.6180125E-07	1.5438678E-06	2.5858706E-06	3.2419073E-06	3.3270865E-06	3.3388824E-06
UPSILON-PCP	4.5296981E 08	5.8251620E 08	1.1592846E 09	2.7740707E 09	9.0101653E 09	8.9783334E 11
UPSILON-GCP	3.8906936E 08	3.9979295E 08	2.1881500E 08	1.5584150E 08	5.0144732E 07	5.0647164E 05
DELTA	5.6093746E 15	1.8906248E 16	7.5149999E 15	1.1730000E 08	0.	0.
DELTA/OMEGA-CP	1.9709032E-02	1.5496682E-01	1.0317133E-01	2.0189328E-09	0.	0.

N-E= 1.0E 24
LAMBDA-I= 1.0000004E-08 E-F-0= 3.6457444E 01 T-E-0= 4.2307007E 05 OMEGA-P= 5.6412531E 16 LAMBDA-OP= 3.3388825E-06

T-E= 1.0E 07
P-E= 1.3624228E 09 LAMBDA-S= 2.1824244E-08 DELTA-Q/DELTA ARG= 2.1542406E-02 DELTA-Q/DELTA= 1.0000770E 00

LAMBDA-W	3.0000000E-08	9.9999999E-08	3.0000000E-07	1.0000000E-06	9.9999999E-05	9.9999999E-03
K	2.0943951E 08	6.2831852E 07	2.0943951E 07	6.2831852E 06	6.2831852E 04	6.2831852E 02
OMEGA-0	6.2784937E 18	1.8835481E 18	6.2784938E 17	1.8835481E 17	1.8835481E 15	1.8835481E 13
EPSILON	9.9991926E-01	9.9910299E-01	9.9192690E-01	9.1029890E-01		
V-EMP	2.9978810E 10	2.9991054E 10	3.0099343E 10	3.1419903E 10		
P					3.3407451E-06	3.3388826E-06
OMEGA-CP	1.8243319E 18	2.1552528E 17	7.4091725E 16	5.8003657E 16	5.6412690E 16	5.6412531E 16
OMEGA-CP/OMEGA-P	3.2339126E 01	3.8205214E 00	1.3133913E 00	1.0282052E 00	1.0000028E 00	1.0000000E 00
LAMBDA-OCP	1.0324591E-07	8.7393372E-07	2.5421842E-06	3.2472920E-06	3.3388731E-06	3.3388825E-06
UPSILON-PCP	8.7109434E 09	3.4301914E 09	3.5376193E 09	9.2315688E 09	8.9783584E 11	8.9783331E 13
UPSILON-GCP	5.2204217E 08	1.3256610E 09	1.2854043E 09	4.9257836E 08	5.0647020E 06	5.0647162E 04
DELTA	3.6142938E 14	1.0509107E 16	3.3811902E 16	3.8797056E 07	-0.	-0.
DELTA/OMEGA-CP	1.9811382E-04	4.8760436E-02	4.5635193E-01	6.6887257E-10	-0.	-0.
OMEGA-OP	1.8300457E 18	2.1557156E 17	7.4092295E 16	5.8003662E 16	5.6412690E 16	5.6412531E 16
OMEGA-OP/OMEGA-P	3.2440412E 01	3.8213418E 00	1.3134014E 00	1.0282053E 00	1.0000028E 00	1.0000000E 00
LAMBDA-OOP	1.0292355E-07	8.7374609E-07	2.5421646E-06	3.2472917E-06	3.3388731E-06	3.3388824E-06
UPSILON-POP	8.7378248E 09	3.4309280E 09	3.5376465E 09	9.2315695E 09	8.9783584E 11	8.9783331E 13
UPSILON-GOP	5.2377611E 08	1.3261474E 09	1.2854775E 09	4.9258118E 08	5.0647020E 06	5.0647162E 04
DELTA-Q	3.6149321E 14	1.0509916E 16	3.3814505E 16	3.8800043E 07	-0.	-0.
DELTA-Q/OMEGA-OP	1.9751048E-04	4.8753721E-02	4.5638356E-01	6.6892402E-10	-0.	-0.

WITHOUT OMEGA-CP APPROXIMATELY EQUAL TO OMEGA-P

OMEGA-CP	2.9781247E 17	1.1790000E 17	7.4699999E 16	5.8000000E 16	5.6412532E 16	5.6412532E 16
OMEGA-CP/OMEGA-P	5.2791899E 00	2.0899611E 00	1.3241738E 00	1.0281403E 00	1.0000000E 00	1.0000000E 00
LAMBDA-OCP	6.3246114E-07	1.5975811E-06	2.5214835E-06	3.2474968E-06	3.3388824E-06	3.3388824E-06
UPSILON-PCP	1.4219498E 09	1.8764368E 09	3.5666623E 09	9.2309867E 09	8.9783334E 11	8.9783334E 13
UPSILON-GCP	1.2306086E 09	1.2771628E 09	6.8890668E 08	4.6954527E 08	5.0647191E 06	5.0647159E 04
DELTA	5.2968745E 15	2.0100000E 16	8.5699999E 15	8.9999999E 06	0.	0.
DELTA/OMEGA-CP	1.7789939E-02	1.7048346E-01	1.1472557E-01	1.5517241E-10	0.	0.

NASA-Langley, 1963 E-1879