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JOINT INSTITUTE FOR LABORATORY ASTROPHYSICS

UNIVERSITY OF COLORADO

REPORT

NATIONAL BUREAU OF STANDARDS

RECENT WORK ON STELLAR INTERIORS:
A BIBLIOGRAPHY OF MATERIAL PUBLISHED BETWEEN
1958 AND MID-1966

prepared by

Edward Langer, Margaret Herz, and J. P. Cox

GPO PRICE $ ______

CFSTI PRICE(S) $ ______

Hard copy (HC) 2.00

Microfiche (MF) .65

ff 653 July 65

JILA REPORT No. 88

University of Colorado

Boulder, Colorado

December 9, 1966

N67 17997
(ACCESSION NUMBER)
(THRU)
122
(PAGES)
1
(CODE)
CR-81654
(NASA CR OR TMX OR AD NUMBER)
30
(CATEGORY)
FACILITY FORM 602

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NOTICE

This report is NOT being published in any other form.

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This work was supported in part by the Advanced Research Projects Agency (PROJECT DEFENDER), monitored by the U.S. Army Research Office-Durham, under Contract DA-31-124-ARO-D-139, through the University of Colorado, and in part by National Science Foundation Grant No. GP4859, through the University of Colorado. One of us, Edward Langer, is grateful to the National Aeronautics and Space Administration for support by a NASA Traineeship.

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INTRODUCTION

This bibliography of recently published material on stellar interiors and closely related subjects has been compiled in the hope that it might be useful to students and workers in the field. Since the review article on stellar evolution by Burbidge and Burbidge* contains a comprehensive bibliography on the relevant literature published before 1958, this report lists only articles (834) published between 1958 and mid-1966. Section I is the only exception. It contains most of the significant books (in the English language) relevant to the general problem of stellar interiors published to date.

The articles are listed alphabetically by author (by the first author in cases of multiple authorship, and by date in cases of several articles by the same first author) in several different categories. Each paper (with the exception of the paper by Hayashi, Hōshi, and Sugimoto (1962)) is entered only once despite the fact that many entries might have been properly fitted into more than one category. This makes the report shorter--and, unfortunately, a few things more difficult to find.

The mass, initial composition, construction technique, equation(s) of state, modes of energy transport, and kinds of energy sources included are summarized briefly for each stellar interior model that was actually constructed. A table of these models, arranged by mass and composition,

*Burbidge, E. M. and Burbidge, G. R. (1958) Handbüch der Physik, S. Flügge, ed., Vol. 51: Astrophysics II: Stellar Structure, p. 134.

appears in the appendix. In general, the notation employed here follows conventional usage in stellar interior studies.* In particular, the X, Y, and Z that appear in the stellar model summaries are the usual fractional mass abundances of hydrogen, helium, and "heavy elements," respectively. Evolving models are designated by an (E). Only the title of the paper and a reference to the journal in which it appears is included for all other entries.

A list of abbreviations used in this report for the titles of journals is given immediately following this introduction.

The present bibliography was not intended to be complete, and some of the less readily available journals have not been searched. Essentially all of the articles entered in this report are written in English, French or German. We hope, however, that this compilation is comprehensive enough to be useful.

We wish to thank Drs. M. S. Vardya and T. N. Divine for their comments and for suggesting a number of ways of preparing a more useful bibliography.

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*See, for example, Schwarzschild, The Structure and Evolution of the Stars, 1958.

ABBREVIATIONS

Adv. Astr. Ap.	Advances in Astronomy and Astrophysics, Z. Kopal, ed. (N. Y. Academic Press)
A. J.	Astronomical Journal
Ann. d'Ap.	Annales d'Astrophysique
Ann. d'Phys.	Annales de Physique
Ann. Phys.	Annals of Physics
Ann. Rev. Astr. Ap.	Annual Review of Astronomy and Astrophysics
Ann. Rev. Nuc. Sci.	Annual Review of Nuclear Science
Ap. J.	Astrophysical Journal
Ap. J. Suppl.	Astrophysical Journal Supplement
Austral. J. Phys.	Australian Journal of Physics
B. A. N.	Bulletin of the Astronomical Institutes of the Netherlands
Bull. Amer. Phys. Soc.	Bulletin of the American Physical Society
Canad. J. Phys.	Canadian Journal of Physics
Doklady	Soviet Physics Doklady
Geophysical J. R. A. S.	Geophysical Journal of the Royal Astronomical Society
JETP	Soviet Physics JETP
J. Phys. Soc. Japan	Journal of the Physics Society of Japan
Mém. Soc. R. Sci. Liège	Mémoires de la Société Royale de Science à Liège
Mem. of the R. A. S.	Memoirs of the Royal Astronomical Society

M. N.	Monthly Notices of the Royal Astronomical Society
M. N. ASSA	Monthly Notices of the Astronomical Society of South Africa
Nuclear Phys.	Nuclear Physics
Observ.	The Observatory
Phys. Rev.	Physical Review
Planet. Sp. Sci.	Planetary and Space Science (G.B.)
Proc. Roy. Soc.	Proceedings of the Royal Society
Prog. Theor. Phys.	Progress of Theoretical Physics
Pub. A. S. P.	Publications of the Astronomical Society of the Pacific
Pub. Astr. Soc. Japan	Publications of the Astronomical Society of Japan (Nihon Temmongakkai)
Quart. J. R. A. S.	Quarterly Journal of the Royal Astronomical Society
Rev. Mod. Phys.	Review of Modern Physics
Soviet Astr.	Soviet Astronomy
UCRL	University of California Lawrence Radiation Laboratory
Uspekhi	Soviety Physics Uspekhi
Zs. f. Ap.	Zeitschrift für Astrophysik

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IV. PROTO-STARS AND EVOLUTION PRIOR TO NUCLEAR BURNING

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V. EQUILIBRIUM STAR MODELS AND EVOLUTION DURING NUCLEAR BURNING

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Boundary Conditions for Stellar Interior Models. (Abstract).

B. Stellar Models

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Structure and Evolution of Medium Mass Stars III. Effect of Radiation Pressure on Stellar Models.

Initial Composition:	X = .596, Z = .02.
Mass:	2.0, 2.5, 3.5 and 5.0 $M_\odot$.
Construction Technique:	Fitting.
Equation of State:	Ideal gas; radiation pressure (Model I). These models are compared to models in which radiation pressure is ignored (Model II).
Energy Transport:	Completely convective core; radiative envelope (electron scattering or bound-free and free-free Kramers type opacity).
Energy Sources:	pp chain, CNO cycle.

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Structure and Evolution of Medium Mass Stars IV. The Early Evolution of a Star of 2 Solar Masses.

Initial Composition:	$X = .596$, $Y = .384$, $Z = .02$, $X_{CN} = .20\ Z$.
Mass:	2(E) $M_\odot$.
Construction Technique:	Fitting.
Equation of State:	Ideal gas, radiation pressure, electron degeneracy.
Energy Transport:	Convective inner core, radiative outer core, radiative envelope (Cox Tables), and a surface convective region where H I, He I and He II are partially ionized.
Energy Sources:	pp chain, CNO cycle, gravitational potential energy changes.

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Structure and Evolution of Medium Mass Stars I. Main-Sequence Model of 2.5 Solar Masses.

Initial Composition:	$X = .70$, $Y = .28$, $Z = .02$, $X_{CN} = .19\ Z$.
Mass:	2.5 $M_\odot$.
Construction Technique:	Fitting.
Equation of State:	Ideal Gas.
Energy Transport:	Convective core; radiative envelope-Kramers type opacity plus electron scattering (as in Iben, Ehrman 1962).
Energy Sources:	pp chain, CN cycle; (interpolative fit to Wrubel 1958) sources in the outer radiative zone are included.

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Initial Composition:	$X = .73$, $Y = .25$, $Z = .02$.
Mass:	1.48 $M_\odot$.
Construction Technique:	Fitting.
Equation of State:	Ideal gas throughout.
Energy Transport:	Polytropic core ($n = 1.5$); radiative zone (opacities are an interpolative fit to Keller-Meyerott 1955); convective envelope (an E solution).

Energy Sources:	pp-chain, CNO bi-cycle-interpolation to fit BBFH (1957) Fowler (1960), Cameron (1957).

482. Bodenheimer, P. (1965) Ap. J., 142, 451.
Studies in Stellar Evolution II. Lithium Depletion During the Pre-Main Sequence Contraction.

Initial Composition:	X = .66, Z = .0264,	X = .38, Z = .015
Mass:	1.0(E), 0.8(E), 1.2(E) $M_\odot$	.5(E), .59(E), .68 (E) $M_\odot$.
Construction Technique:	Henyey.	
Equation of State:	Ideal gas, radiation pressure, incomplete ionization, degeneracy.	
Energy Transport:	Fully convective pre-main sequence contraction, mixing length theory is used in outer convection zone. The radiative opacity used upon the onset of the radiative core is from BFGH (1965).	
Energy Sources:	pp chain, CNO bi-cycle cf. BFGH (1965), $Li^7(p,\alpha)He^4$, $Li^6(p,\alpha)He^3$ burning, gravitational energy release.	

483. Boury, A. (1960) Bull. Soc. R. Sci. Liege, 29, 306.
Modelés des étoiles composés d'hydrogéne.

Initial Composition:	X = 1.
Mass:	$20 \leq M/M_\odot \leq 6650$.
Energy Transport:	Convective core; outer radiative zone, electron scattering opacity.

484. Boury, A. (1963) Mém. Soc. R. Sci. Liege, 8, #6.
Contribution á l'étude des étoiles formées initialement d'hydrogéne pur.

Initial Composition:	X = 1.0.
Masses:	174(E), 306(E), 611(E), 1515(E), 6645(E) $M_\odot$.
Construction Technique:	Fitting.
Equation of State:	Ideal gas, radiation pressure.
Energy Transport:	Convective core, radiative envelope (electron scattering opacity).
Energy Sources:	pp chain, 3α reaction, CNO chain.

Energy Sources: pp, CN (interpolative fit to B^2FH 1957 and Fowler 1958) the ratio of the energy produced by pp to that produced by CN is the free parameter in the model. A value of .327472 gives the best fit to the empirical Main-Sequence.

480. Blackler, J. M. (1958) M. N., 118, 37.
Models for Main Sequence Stars.

Initial Composition: X = .76, Z = .0025, X = .85, Z = .0025
X = .93, Z = .0025, X = .99, Z = .0025
Z is all CN.

Masses: 1(E), 2(E), 4(E), 8(E), 16(E), 32(E), 64(E), 128(E) $M_\odot$ for each composition.

Construction Technique: Fitting.

Equation of State: Ideal gas, radiation pressure.

Energy Transport: Interpolative fit to Keller-Meyerott opacities in radiative zones.

Energy Sources: pp, CN interpolation formulae, early evolutionary stages are calculated for X = .85 for each mass.

(See Haselgrove and Hoyle, M. N. 1956).

481. Bodenheimer, P., Forbes, J. E., Gould, N. L. and Henyey, L. G.(1965) Ap. J., 141, 1019.
Studies in Stellar Evolution I. The Influence of Initial CNO Abundance in a Star of Mass 2.3.

Initial Composition:
I. H = .68, He^4 = .29, C^{12} = .0042, C^{13} = 5.4(-5)*, N = 1.45(-3), O = 1.31(-2).
II. H = .68, He^4 = .29, C^{12} = .00016, C^{13} = 5.4(-5), N = 5.49(-3), O = 1.31(-2).
III. H = .68, He^4 = .29, C^{12} = .00016, C^{13} = 5.4(-5), N = 1.359(-2), O = 5(-3).
IV. H = .68, He^4 = .29, C^{12} = .0028, C^{13} = 3.6(-5), N = 9.67(-4), O = 8.74(-3).

Mass: 2.3 $M_\odot$.

Construction Technique: Henyey.

Equation of State: Ideal gas, radiation pressure, incomplete ionization, degeneracy.

Energy Transport: Opacity: interpolative fit to Keller Meyerott Table updated to Cox and Eilers values. Includes electron conduction.

*Numbers in parentheses are the powers of 10 by which the corresponding entries are to be multiplied.

485. Cimino, M., Giannone, P., Giannuzzi, M. A., Masani, A. and Virgopia, N. (1963) Nuovo Cimento, 28, 621.
Massive Homogeneous Helium-Star Models.

Initial Composition:	X = 0, Y = .98, Z = .02.
Mass:	2.9, 5.5, 9.0, 14.6, 24.3, 43.0, 85, 214 $M_\odot$.
Construction Technique:	Fitting.
Equation of State:	Ideal gas, radiation pressure.
Energy Transport:	Electron scattering opacity in envelope, convective core.
Energy Sources:	3α alone-interpolation formula.

486. Cox, J. P. and Guili, R. T. (1961) Ap. J., 133, 755.
Equilibrium Models for Stars which Derive Energy from Helium Burning, I. Stars composed of Pure Helium.

Initial Composition:	X = 0, Y = 1.0.
Mass:	.5, 1, 2, 3, 4, 5, 6, 7, 8, 9 $M_\odot$.
Construction Technique:	Fitting.
Equation of State:	Ideal gas.
Energy Transport:	Convection in core (n = 1.5), radiative envelope with electron scattering opacity.
Energy Sources:	Entirely 3α helium burning (Salpeter 1957).

487. Cox, J. P. and Salpeter, E. E. (1961) Ap. J., 133, 764.
Equilibrium Models for Stars which Derive Energy from Helium Burning, II. Helium Stars with Hydrogen Rich Envelopes.

Hydrogen rich envelopes are fitted to the previous models (Cox and Guili 1961). The main result is a greatly expanded radius and reduced effective temperature.

488. Cox, J. P. and Salpeter, E. E. (1964) Ap. J., 140, 485.
Equilibrium Models for Helium Burning Stars, III. Semi-Degenerate Stars of Small Mass.

Initial Composition:	X = 0, Y = 1.0.
Mass:	.31, .35, .40, .50, .75, 1.0, 1.25, 1.50, 2.0, 4.0, 8.0 $M_\odot$ initial models; .31(E), .50(E), 1.0(E), 2.0(E) $M_\odot$ inhomogeneous evolving models.

Construction Technique: Fitting, radiative zero boundary conditions.

Equation of State: Non-relativistic, partially degenerate electrons, ideal ions.

Energy Transport: Convective core; electron conduction and electron scattering opacity in the radiative envelope.

Energy Sources: 3α reaction in homogeneous models; $C^{12}(\alpha,\gamma)O^{16}$ added in inhomogeneous models (Reeves, 1964).

489. Deinzer, W. and Salpeter,E. E. (1964) Ap. J., 140, 499.
Equilibrium Models for Helium-Burning Stars, IV. Massive Stars and Nuclear Abundances.

Initial Composition: $X = 0$, $Y = 1.0$.

Mass: .4832, .9844, 2.292, 3.986(E), 6.588, 14.80(E), 32.10, 78.21(E), 387.7(E), 4705(E), ∞, $M_\odot$ for homogeneous models.

Construction Technique: Fitting.

Equation of State: Ideal gas, radiation pressure. (degenerate corrections made for small M).

Energy Transport: Electron scattering opacity.

Energy Sources He Burning, 3α reaction for initial homogeneous models (Salpeter 1957), $C^{12}(\alpha,\gamma)O^{16}$, $O^{16}(\alpha,\gamma)Ne^{20}$, $Ne^{20}(\alpha,\gamma)Mg^{24}$, $Mg^{24}(\alpha,\gamma)Si^{28}$ included for evolving inhomogeneous models. (Reeves 1964).

490. Deinzer, W. and Salpeter, E. E. (1965) Ap. J., 142, 813.
Models for Carbon-Burning Stars.

Initial Composition: $X = Y = 0$, $Z = 1$, Carbon burning models are consistent with $X_c \sim .02$ to .03.

Masses: .499, .454, .718, .963, 1.538, 5.22, 9.97, 26.73 ($T_c = 3 \times 10^8$°K, without neutrino), .819, .796, .972, 1.623 (with neutrinos), 1.645, 5.58 ($T_c = 5 \times 10^8$°K, without neutrinos), 19.4, 27.2 (with neutrinos), (for the gravitational contracting models).

Construction Technique: Fitting.

Equation of State: See Deinzer and Salpeter (above).

Energy Transport: See Deinzer and Salpeter (above), opacity includes relativistic correction to electron scattering.

Energy Sources: Carbon Burning (Reeves 1963) or gravitational potential energy release. Neutrino sink is included and these models are compared with identical models without neutrino losses.

491. Demarque, P. (1960) A. J., 65, 396.
Interior Models for Subdwarf Stars.
(Abstract in A. J., 64, 327).

Initial Composition:	X = .75, Z = .001, X = .75, Z = .01, X = .999, Z = .001, X = .99, Z = .01.
Mass:	.6, .8, 1.0 $M_\odot$.
Construction Technique:	Fitting.
Equation of State:	Perfect gas.
Energy Transport:	Convective envelope; radiative core, opacity is an interpolative fit to Keller Meyerott.
Energy Sources:	pp chain.

492. Demarque, P. (1960) Ap. J., 132, 366.
The Structure of Population II Stars.

Initial Composition:	X = .999, Z = .001; X = .99, Z = .01; X = .75, Z = .005; X = .75, Z = .001; X = .75, Z = .01.
Mass:	.6, .8, 1.0 $M_\odot$.
Construction Technique:	Fitting.
Equation of State:	Perfect gas.
Energy Transport:	Inner radiative zone-interpolative fit to Keller Meyerott opacities. Outer convective zone - adiabatic convection in inner part, mixing length theory in outer parts.
Energy Sources:	pp chain $\varepsilon = \varepsilon_o \rho T^4$ interpolation formula.

493. Demarque, P. (1961) Ap. J., 134, 9.
Models for Lower Main Sequence Population II Stars.

For particulars see the paper above (Demarque 1960). These models just show the effect of changing the mixing length to 2x the pressure scale height in the convective zone.

494. Demarque, P. and Geinsler, J. E. (1963) Ap. J., 137, 1102.
Models for Red Giant Stars I.

Initial Composition:	$X = .999$, $Y = 0$, $Z = .001$ (Both masses); $X = .99$, $Y = 0$, $Z = .01$ ($1.2\ M_\odot$); $X = 1$, $Y = 0$, $Z = 0$ ($1.2\ M_\odot$); $X = .749$, $Y = .25$, $Z = .001$ ($1.2\ M_\odot$).
Mass:	1.0(E), 1.2(E)$M_\odot$.
Construction Technique:	Fitting.
Equation of State:	Partially degenerate electrons, ideal nucleii in core, ideal gas outside.
Energy Transport:	Isothermal core; radiative zone-Keller Meyerott opacities with bound-bound neglected; outer convective zone - mixing length theory with $\ell \equiv$ pressure scale height.
Energy Sources:	CN cycle, pp cycle ($He^3(He^3,2H)He^4$; $He^3(\alpha,\gamma)Be^7(\alpha,\gamma)Li^7(p,\gamma)He^4$)- interpolation formula.

495. Demarque, P. R. and Larson, R. B. (1964) Ap. J., 140, 544.
The Age of Galactic Cluster NGC 188.

Initial Composition:	$X = .57, .67, .77$, $Z = .03$.
Masses:	.8(E), .9(E), 1.0(E), 1.1, 1.2, 1.3, 1.4 $M_\odot$ (only the $X = .67$ models are evolutionary).
Construction Technique:	Modified Henyey (Demarque and Larson 1964).
Energy Transport:	Keller Meyerott fit in radiative zones, mixing length theory in convective zones, $\ell/H = 1.6, 2$.
Energy Sources:	pp chain (three branches), CN chain -- Reeves 1964.

496. Demarque, P. R. and Percy, J. R. (1964) Ap. J., 140, 541.
A series of Solar Models.

Initial Composition:	$Z = .02$ for $X = .78, .76, .74, .72, .70$; $Z = .025$ for $X = .74, .72, .70, .68, .66$; $Z = .030$ for $X = .72, .70, .68, .66, .64$; $Z = .035$ for $X = .70, .68, .66, .64$; $Z - .040$ for $X = .68, .66, .64$.
Mass:	$1\ M_\odot$ E.
Construction Technique:	Modified Henyey.

Equation of State: Ideal gas, degenerate electrons.

Energy Transport: Fit to Keller-Meyerott opacities in radiative zone; mixing length theory in outer convection zone.

Energy Sources: Reeves (1964).

497. Divine, N. (1965) Ap. J., 142, 824.
Structure and Evolution of Model Helium Stars.

Initial Composition: X = 0.0, Y = 0.999, Z = 0.001.

Mass: 0.4, 0.5(E), 0.620, 0.765, 0.8, 1.0(E), 1.25, 1.5, 2.0, 3.0, 4.0, 6.0(E), 8.0, 10.0, 12.5, 14.8, 20.0, 32.1, 40.0, 60.0 $M_\odot$.

Construction Technique: Henyey.

Equation of State: Radiation pressure; ideal ions; ionization of He; semi-relativistic, partially degenerate electrons.

Energy Transport: Electron scattering opacity, surface ionic opacity. Central degenerate electron conduction, convective core.

Energy Sources: Gravitational Contraction; 3α, $C^{12}(\alpha,\gamma)O^{16}$, $O^{16}(\alpha,\gamma)Ne^{20}$ Reactions.

498. Ezer, D. (1961) Ap. J., 133, 159.
Models of Massive Pure Hydrogen Stars.

Initial Composition: X = 1.0.

Mass: 1, 2, 5, 10, 20, 50, 100, 200, 300, 500, 750, 1000, 2000 $M_\odot$.

Construction Technique: Fitting.

Equation of State: Ideal gas, radiation pressure.

Energy Transport: Convective core (n = 1.5); Kramers opacity, interpolation for κ_o in radiative zones.

Energy Sources: pp chain ($He^3(He^3,2p)He^4$) interpolation formula B^2FH(1957) corrected by Fowler (1959).

499. Ezer, D. and Cameron, A. G. W. (1965) Canadian J. of Phys., 43, 1497.
A Study in Solar Evolution.

Initial Composition: $X = .739$, $Y = .240$, $Z = .021$, $X_{C^{12}} = 4.618 \times 10(-3)$, $X_{N^{14}} = .97 \times 10(-3)$ $X_{O^{16}} = 1.0715 \times 10(-2)$.

Mass: $1.0\ M_\odot$ (E).

Construction Technique: Henyey Method.

Equation of State:

Energy Transport: Radiative Zones; Los Alamos opacity tables. Convective zones; mixing length theory. ($\ell = 2H$).

Energy Sources: Gravitational Energy; H^2, He^3 burning, 2 pp chains, CNO bi-cycle (interpolation formulae).

500. Faulkner, J. (1966) Ap. J., 144, 978.
On the Nature of the Horizontal Branch, I. (Models for stars that have passed through the helium flash).

Initial Composition: $\left.\begin{array}{l} X = 0.9 \\ X = 0.65 \end{array}\right\} Z_{CNO} = .5\ Z = 10^{-5}, 10^{-4}, 10^{-3}, 10^{-2}$.

Mass: $1.25\ M_\odot$ ($M_{core} = .4, .5\ M_\odot$).

Construction Technique: Fitting.

Equation of State: Ideal gas, radiation pressure.

Energy Transport: Electron scattering, bound-free, free-free fit to Keller Meyerott. Central convection.

Energy Sources: 3α reaction, CNO bi-cycle, pp reaction.

501. Faulkner, J. and Iben, I. Jr. (1966) Ap. J., 144, 995.
The Evolution of Population II Stars.

Initial Composition:	$X = .65$ $Z_{CNO} = Z/2 = 10^{-3}, 10^{-4}, 10^{-5}$	.90 10^{-4}	.90 10^{-5}.
Masses:	.65,.70,.75 1.0, 1.25(E)	.70,.75 1.25(E) 1.0,1.25(E).	

Rest as in Iben (1965) except that electron degeneracy is included.

502. Giannone, P. and Giannuzzi, M. A. (1965) Nuovo Cimento, 36, 1267.
Helium Burning Evolution of Massive Stars.

Initial Composition:	X = 0.0, Y = .98, Z = .02.
Mass:	2.9 (E), 14.6(E) $M_\odot$.
Construction Technique:	Fitting.
Equation of State:	Ideal gas, radiation pressure.
Energy Transport:	Convective core; radiative envelope with electron scattering opacity.
Energy Sources:	3α, $C^{12}(\alpha,\gamma)O^{16}$, $O^{16}(\alpha,\gamma)Ne^{20}$ reactions.

Evolution is carried to helium exhaustion in the core. Abundances of the elements are followed and compared.

503. Hamada, T. and Salpeter, E. E. (1961) Ap. J., 134, 683.
Models for Zero Temperature Stars.

Initial Composition:	He^4, C^{12}, Mg^{24}, Si^{28} S^{32},or F^{56}, and one with equilibrium composition of these.
Masses:	He^4: .154, .213, .305, .399, .499, .609, .734, .885; C^{12}: .147, .488, .597, .722, .872, 1.07, 1.206, 1.318, 1.366, 1.381, 1.396, 1.349, 1.174; Mg^{24}: .139, .196, .286, .378, .476, .584, .708, .857, 1.053, 1.19, 1.3, 1.348, 1.363, 1.282, 1.205; Si^{28}: 1.319, 1.343, 1.175; Si^{32}: 1.011, 1.169, 1.064, 1.067, 1.047; Fe^{56}: .007, .015, .015, .024, .046, .103, .149, .222, .298, .380, .471, .576, .703, .872, .991, 1.088, 1.112, 1.093, 1.028, 1.014, .990.
Construction Technique:	Numerical integration of the mechanical equilibrium equations.
Equation of State:	Salpeter (1961) for matter at high densities.
Energy Transport:	None, Zero temperature stars.
Energy Sources:	None, Zero temperature stars.

504. Härm, R. and Schwarzschild, M. (1964) Ap. J., 139, 594.
Red Giants of Population II. III.

Initial Composition:	X = .9, Y = .099, Z = .001 (M = 1.0, 1.3); X = .9, Y = .09, Z = .01 (M = 1.3).
Mass:	1.0(E), 1.3(E) M_Θ.
Construction Technique:	Henyey method.
Equation of State:	
Energy Transport:	Isothermal degenerate core; convective envelope--interpolation formula at boundary.
Energy Sources:	See earlier paper (1962) for other assumptions--difference here is the Henyey method.

505. Haselgrove, C. B. and Hoyle, F. (1958) M. N., 118, 519.
Giant Stars of Type II (see Haselgrove and Hoyle 1956, M. N.).

Initial Composition:	X = .9309, Y = .0666, Z = .0025.
Mass:	1.27 (E) M_Θ.
Construction Technique:	Fitting.
Equation of State:	Ideal gas, radiation pressure.
Energy Transport:	Conduction included, interpolated radiative opacity.
Energy Sources:	pp, CN cycles - interpolation formulae.

506. Haselgrove, C. B. and Hoyle, F. (1959) M. N., 119, 112.
Main Sequence Stars.

Initial Composition:	I	X = .75, Y = .24, Z = .01
	II	X = .99, Y = .009, Z = .001
	III	X = .75, Y = .249, Z = .001.
Masses:	I	1.01, 1.09, 1.19, 1.29, 1.40, 1.46, 1.52, 1.97, 2.89, 3.44, 3.90, 5.97, 8.95, 13.4, 20.1, 30.2, 37.0, 55.5, 83.3, 125. M_Θ.
	II	1.06, 1.20, 1.25, 1.35, 1.47, 1.60, 1.74, 2.07, 2.46, 2.68, 2.91, 3.47, 4.00 M_Θ.
	III	.987, 1.02, 1.17, 1.34, 1.43, 1.52, 1.61, 1.94, 2.43, 3.05 M_Θ.
Construction Technique:		Fitting.
Equation of State:		Ideal gas, radiation pressure.

Energy Transport: Radiative zones--fit to Keller-Meyerott tables (10%), conduction was included and a special solution for the outermost zones is described.

Energy Sources: pp chain (three branches), CN cycle--interpolation formulae .

507. Hayashi, C., Jugaku, J. and Nishida, M. (1959) Prog. Theor. Phys., 22, 531.
Evolution of Massive Stars II. Helium Burning Stage.
(Note in Ap. J., 131, 241).

Initial Composition: $X = .90$, $Y = .08$, $Z = .02$, $X_{CN} = Z/3$.

Mass: $15.6\ M_{\odot}$ (E).

Construction Technique: Fitting.

Equation of State: Ideal gas, radiation pressure.

Energy Transport: Electron scattering opacity in radiative zones, convective core.

Energy Sources: 3α process in core, CN cycle in outer shell } interpolation formulae.

508. Hayashi, C., Nishida, M. and Sugimoto, D. (1961) Prog. Theor. Phys., 25, 1053.
Evolution of a Star with Intermediate Mass after Hydrogen Burning.

509. Hayashi, C., Nishida, M. and Sugimoto, D. (1962) Prog. Theor. Phys., 27, 1233.
Evolution of a Star with Intermediate Mass after Hydrogen Burning, I.

Initial Composition: $X = .61$, $Y = .37$, $Z = .02$, $X_{CNO} = .008$
Model begins with $X = 0$ in core.

Mass: $4\ M_{\odot}$ (E).

Construction Technique: Fitting.

Equation of State: Ideal gas.

Energy Transport: Radiative zones-outer, B-F Kramers opacity; inner, electron scattering.

Energy Sources: CNO cycle, 3α reaction } interpolation formulae (B^2FH 1957) (Salpeter 1957).

510. Hayashi, C., Hōshi, R. and Sugimoto, D. (1962) Prog. Theor. Phys. Suppl. #22.
Evolution of the Stars.

Includes many results for the 15.6 and 4.0 $M_\odot$ stellar models described in the papers above. This paper also includes work on a 0.7 $M_\odot$ model, on the pre-main sequence contraction, and on the white dwarf and pre-white dwarf stages of evolution.

511. Hayashi, C. and Cameron, R. C. (1962) Ap. J., 136, 166.
The Evolution of Massive Stars III. Hydrogen Exhaustion through the Onset of Carbon Burning.
(Notes in A. J., 65, 490; 67, 577).

Initial Composition:	$X = .90$, $Y = .08$, $Z = .02$, $X_{CNO} = Z/3$, (15.6 $M_\odot$, evolution is carried to onset of C^{12} or Ne^{20} burning.) $X = .61$, $Y = .37$, $Z = .02$, (10.1 $M_\odot$.)
Mass:	15.6(E), 10.1(E) $M_\odot$.
Construction Technique:	Fitting.
Equation of State:	Perfect gas, radiation pressure.
Energy Transport:	Radiative opacity is electron scattering alone.
Energy Sources:	CNO, pp, 3α interpolation formulae (Fowler 1960, Salpeter 1957); gravitational contraction included.

512. Hayashi, C. and Cameron, R. C. (1964) A. J., 69, 140.
Evolution with Neutrino Loss of a Massive Star until the Onset of Carbon Burning.
(Abstract).

513. Hayashi, C., Hōshi, R. and Sugimoto, D. (1965) Prog. Theor. Phys., 34, 885.
Advanced Phases of Evolution of Population II Stars -- growth of the Carbon Core and the Shell Helium Flashes.

(Continuation of Prog. of Theor. Phys. Suppl #22 by same authors).

514. Henyey, L. G., LeLevier, R. and Levée, R. D. (1959) Ap. J., 129, 2.
Evolution of Main Sequence Stars.

Initial Composition:	$X = .68$, $Y = .31$, $Z = .01$, evolution carried till $X \sim 0$ in the core.
Mass:	1.5(E), 2(E), 3.5(E), 6(E), 11(E), 20(E), 30(E).

Construction Technique: Henyey.

Equation of State: Ideal gas, radiation pressure, degeneracy (by interpolation formula).

Energy Transport: Convective cores; interpolative fit to Keller-Meyerott, (40%) opacities in radiative zones.

Energy Sources: pp chain completed by $He^3(He^3,2p)He^4$--interpolation to fit Salpeter 1950; CN chain--interpolation to fit Bosemann-Crespin 1954 values.

515. Hitotuyanagi, Z. and Suda, K. (1958) Pub. Astr. Soc. Japan, 10, 8. Stellar Models with Isothermal Cores and Intermediate Convective Zones.

Initial Composition: μ_i/μ_e = 1.0, 1.5788, 2.5, 2.6667.

Mass: 1.82 $M_\odot$ (E).

Construction Technique: Fitting.

Equation of State: Ideal Gas.

Energy Transport: $p = E^{2.5}$ in intermediate convective zone. Kramers opacity in outer radiative zones.

Energy Sources: Shell source; interpolation formula.

516. Hofmeister, E., Kippenhahn, R. and Weigert, A. (1964) Zs. f. Ap., 59, 242. Sternentwicklung II. Die Wasserstoff-brennende Phase eines Sternes von 7.0 Sonnenmassen.

Initial Composition: X = .602, Y = .354, Z = .044.

Mass: 7 $M_\odot$ (E).

Construction Technique: Henyey (see Hofmeister, Kippenhahn, Weigert 1964).

Equation of State: Ideal gas.

Energy Transfer: Outer Convective Zone: mixing length theory, ℓ = 1.5 the pressure scale height. Outer radiative layers: opacities from tables by Baker(line absorption ignored). Inner Radiative layers: Opacity table derived from Keller-Meyerott tables (line absorption ignored), electron scattering, electron conduction included.

Energy Sources: CNO bi-cycle initially, pp cycles (in shell), 3α process (in core) are ignited in later stages--interpolation formulae used.

517. Hofmeister, E., Kippenhahn, R. and Weigert, A. (1964) Zs. f. Ap. 60, 57.
Sternentwicklung III. Die Helium-brennende Phase und die Cepheidenstadian eines Sterns von 7.0 Sonnenmassen.

See paper II above. This is a continuation through the Helium Burning Phase.

518. Hoyle, F. (1959) M. N., 119, 124.
The Ages of Type I and Type II Subgiants.

Initial Composition: $X = .99$, $Y = .009$, $Z = .001$ 1.35 $M_\odot$; $X = .75$, $Y = .249$, $Z = .001$ 1.16 $M_\odot$; $X = .75$, $Y = .24$, $Z = .01$ 1.09 $M_\odot$.

Mass: 1.09(E), 1.16(E), 1.35(E) $M_\odot$.
See Haselgrove and Hoyle (1959) for details.

519. Hoyle, F. (1960) M. N., 120, 22.
On the Main-Sequence Band and the Hertzsprung Gap.

Initial Composition: $X = .75$, $Y = .23$, $Z = .02$, evolution to the point where $X_c \sim 0$ is considered.

Mass: 1.52(E), 3.89(E), 8.94(E), 30.1(E) $M_\odot$.

See Haselgrove and Hoyle (1959) for the rest.

520. Iben, I. Jr. and Ehrman, J. R. (1962) Ap. J., 135, 770.
The Internal Structure of Middle Main Sequence Stars.

Initial Composition: I. $X = .8$, $Z = .02$; II. $X = .7$, $Z = .02$; III. $X = .6$, $Z = .02$; IV. $X = .75$, $Z = .015$; V. $X = .8$, $Z = .01$; VI. $X = .7$, $Z = .01$; $X_{CN} = .18\ Z$.

Mass: Composition
I. 1.25, 1.581, 1.794, 2.10, 2.63 $M_\odot$;
II. .886, 1.05, 1.256, 1.354, 1.506, 1.866, 2.280, 2.864 $M_\odot$;
III. .0865, 1.21, 1.303, 1.563, 1.86, 2.26 $M_\odot$;
IV. 1.112, 1.44, 1.596, 1.87, 2.135, 3.078 $M_\odot$;
V. 1.175, 1.420, 1.706, 2.02, 2.32, 2.85 $M_\odot$;
VI. 2.172, 1.811, 1.470, 1.07 $M_\odot$.

Construction Technique: Fitting.

Equation of State: Ideal Gas.

Energy Transport: Radiative opacities are an interpolative fit to Keller-Meyerott values.

Energy Sources: pp chains, and CN cycle-interpolation formula.

521. Iben, I. Jr. (1965) Ap. J., 142, 1447.
Stellar Evolution II. The Evolution of a 3 $M_\odot$ Star from the Main Sequence through Core Helium Burning.

Initial Composition: $X = 0.708$, $Z = 0.02$.

Mass: 3 (E) $M_\odot$.

Construction Technique: Henyey.

Equation of State: Ideal gas; radiation pressure; electron degeneracy except in surface regions.

Energy Transport: Convective core; free-free, bound-free absorption, and electron scattering radiative opacity (cf. Iben and Ehrman 1962 (use in interior) and Iben 1963 (in regions of partial H-ionization)). Electron conduction is included.

Energy Sources: pp chain, CN cycle, gravitational contraction, C^{12} depletion.

522. Iben, I. Jr. (1966) Ap. J., 143, 483.
Stellar Evolution III. The Evolution of a 5 $M_\odot$ Star from the Main Sequence through Core Helium Burning.

(As above (Iben, 1965) except the mass is 5 $M_\odot$ (E) and variations in the $C^{12}(\alpha,\gamma)O^{16}$ cross section are considered).

523. Iben, I. Jr. (1966) Ap. J., 143, 505.
Stellar Evolution IV. The Evolution of a 9 $M_\odot$ Star from the Main Sequence through Core Helium Burning.

(As above (Iben, 1965) except the mass is 9 $M_\odot$).

524. Iben, I. Jr. (1966) Ap. J., 143, 516.
Stellar Evolution V. The Evolution of a 15 $M_\odot$ Star from the Main Sequence through Core Helium Burning.

(As above (Iben 1965) except the mass is 15 $M_\odot$. The evolution is compared to that of the less massive stars above and the 15.6 $M_\odot$ model of Hayashi et. al., (1962)).

525. Iinuma, Y. (1959) Sci. Rep. Tôhoku Univ., 43, 232.
Evolutionary Model Sequence of a Star of Ten Solar Masses.

526. Kaminisi, K. (1960) Pub. Astr. Soc. Japan, 12, 398.
The Internal Structure of M Dwarf Stars.

Initial Composition: $X = .664,\ Z = .008$, $X = .500,\ Z = .029$ } $.269\ M_\odot$, $X = .56,\ Z = .01$, $X = .50,\ Z = .03$ } $.209\ M_\odot$, $X = .48,\ Z = .009$ $.162\ M_\odot$.

Mass: $.162,\ .209,\ .269\ M_\odot$.

Construction Technique: Fitting.

Equation of State: Ideal gas, degenerate electrons.

Energy Transport: Convective envelope ($n = 1.5$); radiative core-modified Kramer's opacity (Morse 1940).

Energy Sources: pp cycle, interpolation (B^2FH 1957).

527. Kippenhahn, R., Temesváry, St., and Biermann, L. (1958) Zs. f. Ap., 46, 257.
Sternmodelle I. Die Entwicklung der Stern der Population II.

Initial Composition: $X = .9,\ Y = .1,\ X_{CN} = .0005$.

Mass: $1.2\ M_\odot$ (E).

Construction Technique: Fitting.

Equation of State: Ideal gas, electron degeneracy, radiation pressure.

Energy Transport: Convective (Mixing length theory) plus radiation in outer layers; the radiative opacity includes the effects of the negative H ion, neutral hydrogen, HI ionization, ff and higher ionization and electron scattering by various interpolation formulae.

Energy Sources: pp, CN chain, interpolation formulae (Hoyle-Schwarzschild 1955).

528. Kippenhahn, R., Thomas, H. C. and Weigert, A. (1965) Zs. f. Ap., 61, 241.
Sternentwicklung IV. Zentrales Wasserstoff-und Heliumbrennen bei einem Stern von 5 Sonnenmassen.

Initial Composition: $X = .602,\ Y = .354,\ Z = .044$.

Mass: $5\ M_\odot$ (E).

See papers II, III, (Hofmeister, Kippenhahn, Weigert, 1964). Follows the evolution through helium exhaustion in the core. The results are compared with those for the 7 $M_{\odot}$ Star of papers II and III.

529. Kotok, E. V. (1966) Soviet Astr., 9, 948.
Computation of Early Evolutionary Stages of Stars of 15.6, 20, and 30 Solar Masses.

Initial Composition:	X = .70 Z = .05 X_{CNO} = Z/7	X = .90 Z = .02 X_{CNO} = Z/7.
Masses:	20, 30 $M_{\odot}$(E)	15.6 $M_{\odot}$ (E).
Construction Technique:	Henyey.	
Equation of State:	Ideal gas, radiation pressure.	
Energy Transport:	Free-free and bound-free transitions, electron scattering in radiative opacity. Convective core, intermediate radiative zone as core contracts.	
Energy Sources:	pp chain, CN cycle, gravitational energy.	

530. Kumar, S. S. (1963) Ap. J., 137, 1121.
The Structure of Stars of Very Low Mass.

Initial Composition:	I. X = .90, Y = .09, Z = .01, II. X = .62, Y = .35, Z = .03.
Mass:	.04, .05, .06, .07, .08, .09.
Construction Technique:	Integrate equations for a polytrope.
Equation of State:	Non-relativistic, partially to completely degenerate electrons (see Kumar 1962).
Energy Transport:	Completely Convective (n = 1.5) electron conduction ignored.
Energy Sources:	Gravitational Contraction; H^2, Li^6, Li^7, Be^9, B^{10}, B^{11} burning during contraction.

531. Kung, S. and Chen, D. (1965) Acta Astronomica, 13, 190.
The Evolutionary Track in the H-R Diagram of Model Stars of 1.2 Solar Mass.

Initial Composition:	X = .899, Y = .100, Z = .001, X = .891, Y = .099, Z = .01.
Mass:	1.2 $M_{\odot}$ (E).

Construction Technique: Fitting.

532. Limber, D. N. (1958) Ap. J., 127, 387.
The Structure of M Dwarf Stars, II.

Initial Composition: $X = .75$, $Y = .23$, $Z = .02$.

Mass: .0912, .1, .11, .126, .158, .251, .398, .631, 1.00.

Construction Technique: Completely convective models--fitting unnecessary.

Equation of State: Partially degenerate electrons, ideal ions.

Energy Transport: Adiabatic convection in partially degenerate material.

Energy Sources: pp chain - $\varepsilon = \varepsilon_o \rho T^\nu$, $4 \leq \nu \leq 6.5$ fit to Salpeter 1952.

533. Massevich, A. G. and Volkonskya, T. G. (1960) Soviet Astr., 4, 40.
The Structure of the Sun.

Initial Composition: $X = .995$, $Y = .003$, $Z = .002$.

Mass: 1.0 $M_\odot$.

Construction Technique: Fitting.

Equation of State: Ideal gas.

Energy Transport: Convection in core, Kramers plus electron scattering opacity in radiative zone - fit to Morse 1940.

Energy Sources: pp chain in outer layers, CN chain in core--interpolation formulae.

534. Nagaratnam, A. and Kushwaha, R. S. (1961) Pub. Astr. Soc. Japan, 13, 137.
Initial Model of a Massive Star.

Initial Composition: $X = .75$, $Y = .22$, $Z = .03$.

Mass: 28 $M_\odot$.

Construction Technique: Fitting.

Equation of State: Ideal gas, radiation pressure.

Energy Transport: Convective core, radiative envelope-Kramer's opacity fit to Keller-Meyerott opacities plus electron scattering.

Energy Sources: pp chain, CN chain; interpolation formulae from Haselgrove and Hoyle.

535. Nishida, M. (1960) Prog. Theor. Phys., 23, 896.
On Stellar Models with Double Energy Sources.

Initial Composition: $X = .90$, $Y = .10$, $X_N = .0005$ initial and envelope; begins with pure helium core.

Mass: 1.2 $M_{\odot}$.

Construction Technique: Fitting.

Equation of State: Ideal gas.

Energy Transfer: ff opacity in outer envelope; electron scattering in inner envelope-no contribution from anything other than H, He. Also has a pure He convective core ($n = 1.5$) and an intermediate He radiative zone.

Energy Sources: 3α in He^4 core, CN cycle in thin shell; interpolation formulae (Hayakawa).

536. Nishida, M. and Sugimoto, D. (1962) Prog. Theor. Phys., 27, 145.
Evolution of Population II Stars in Helium-Burning Phase.

See above (Nishida 1960) for details.

537. Oke, J. B. (1961) Ap. J., 133, 166.
Model for a Helium Star of One Solar Mass.

Initial Composition: $X = 0$, $Y = .999$, $Z = .001$.

Mass: 1 $M_{\odot}$.

Construction Technique: Fitting.

Equation of State: Ideal gas.

Energy Transport: Convective core; outer radiative zone, opacity on interpolation to fit Keller-Meyerott tables.

Energy Sources: 3α He burning in core above, ρ^2T^{30} interpolation formula.

538. Osaki, Y. (1963) Pub. Astr. Soc. Japan, 15, 428.
Evolution of Helium Burning Stars of .8 Solar Masses.

Initial Composition:	I $Y = 1$; II. $Y = 1$ for $0 \leq Mr/M \leq .85$, $X = .9$, $Y = .099$, $Z = .001$ in envelope. III. $Y = 1$ for $0 \leq M_r/M \leq .85$, $X = .9$, $Y = .099$, $Z = .001$ in envelope.
Mass:	$.8\ M_\odot$ (E).
Construction Technique:	Fitting.
Equation of State:	Ideal gas, dengerate electrons.
Energy Transport:	Convective core ($n = 1.5$); electron scattering opacity alone in the radiative envelope.
Energy Sources:	3α reaction, $Y^3\rho^2T^{30}$ interpolation formula.

539. Pearce, W. P. and Bahng, J. (1965) Ap. J., 142, 164.
Structure and Evolution of Medium-Mass Stars II. The Extent of the Convective core in Middle Main Sequence Stars.

Initial Composition:	I. $X = .8$, $Z = .02$, $X_{CN} = .19\ Z$ II. $X = .8$, $Z = .01$, $X_{CN} = .19\ Z$ III. $X = .7$, $Z = .02$, $X_{CN} = .19\ Z$ IV. $X = .7$, $Z = .01$, $X_{CN} = .19\ Z$ V. $X = .6$, $Z = .02$, $X_{CN} = .19\ Z$.
Mass:	$0.9\ M_\odot \leq M \leq 2.0\ M_\odot$.
Construction Technique:	Fitting.
Equation of State:	Ideal gas.
Energy Transport:	Convective core; radiative envelope.
Energy Sources:	pp chain, CN cycle - includes energy generation in the envelope.

See Bahng, J., Ap. J., 1964.

540. Pochoda, P. and Reeves, H. (1964) Planet. Space Sci. (GB), 12, 119.
A Revised Solar Model with a Solar Neutrino Spectrum.

Initial Composition:	$X = .68$, $Y = .276$, $Z = .044$, $X_{CN} = .0091$.
Mass:	$1\ M_\odot$.
Construction Technique:	Henyey.
Equation of State:	Ideal Gas.
Energy Transport:	Interpolated opacity - fit to Los Alamos opacities (Cox and Stewart) in radiative zones. Convective envelope has $\log K = -2.25$ chosen to give correct radius.
Energy Sources:	H burning - from Reeves 1964.

541. Pochoda, P. and Schwarzschild, M. (1964) Ap. J., 139, 587.
Variation of the Gravitational Constant and the Evolution of the Sun.

Initial Composition:	$.68 \leq X \leq .81$ Variable with variation in G to give correct present sun. $Z = .04$.
Mass:	1 $M_{\odot}$ (E).
Construction Technique:	Henyey method.
Equation of State:	Ideal gas throughout.
Energy Transport:	Interpolation formula for opacity in envelope; convective core with K chosen to give fit to radius.
Energy Sources:	pp, CN chains - interpolation formulae.

542. Polak, E. J. (1962) Ap. J., 136, 465.
The Transition from Hydrogen-Burning to Helium-Burning in a Star of 5 Solar Masses.

Initial Composition:	$X = .74$, $Y = .24$, $Z = .02$, $X_{CN} = Z/7$. Evolution carried until $X \sim 0$ in core and He burning begins.
Mass:	5 $M_{\odot}$ (E).
Construction Technique:	Fitting.
Equation of State:	Ideal gas.
Energy Transport:	convective core (usual tabulated solution); electron scattering plus modified Kramer's opacity in radiative envelope.
Energy Sources:	Carbon cycle, $\rho X_{CN} T^{16}$ interpolation formula; gravitational energy release in evolution of core.

543. Reiz, A. and Petersen, J. O. (1966) in Stellar Evolution, R. F. Stein and A. G. W. Cameron, eds., 221.
Calculations of Main Sequence Stellar Models.

Initial Composition:	$X = .70$, $Z = .03$, $X_{CNO} = .6\ Z$.
Mass:	6(E), 10(E), 15(E) $M_{\odot}$.
Construction Technique:	Fitting.
Equation of State:	Ideal gas, radiation pressure.
Energy Transport:	radiative opacity tables include bound-free, free-free, and electron scattering contributions.
Energy Sources:	pp chain, CNO cycle (interpolation to Reeves 1964); gravitational energy release.

544. Rouse, C. A. (1965) Bull. Am. Phys. Soc. 10, 14.
A New Solar Model.
(Abstract).

545. Rose, W. K. (1966) Ap. J., 144, 1001.
Helium Shell-Burning Stars of Low Mass with Pure Helium Envelopes.

Initial Composition:	Y = 1.0.
Mass:	.4, .5, .75 $M_\odot$.
Construction Technique:	Henyey.
Equation of State:	Ideal gas, electron degeneracy.
Energy Transport:	Electron scattering and Kramers radiative opacity, electron conduction.
Energy Sources:	3α reaction (Cox and Salpeter, 1964).

546. Sakashita, S., Ôno, Y. and Hayashi, C. (1959) Prog. Theor. Phys., 21, 315.
Evolution of Massive Stars I.

Initial Composition:	X = .90, Y = .08, Z = .02, X_{CN} = Z/3.
Mass:	15.6 $M_\odot$ (E).
Construction Technique:	Fitting.
Equation of State:	Ideal gas, radiation pressure.
Energy Transport:	Electron scattering alone in radiative zones, convective core.
Energy Sources:	CN cycle, ρT^{16} interpolation formula.

547. Sakashita, S. and Hayashi, C. (1959) Prog. Theor. Phys. 22, 830.
Internal Structure and Evolution of Very Massive Stars.

Initial Composition:	X = .9, Y = .08, Z = .02.
Mass:	46.8 $M_\odot$ (E).
Construction Technique:	Fitting.
Equation of State:	Ideal gas, radiation pressure.
Energy Transport:	Electron scattering opacity in envelope, semi-convective intermediate zone and fully convective core.
Energy Sources:	CN cycle, ε ρT^{16} interpolation formula to fit (B^2FH 1957).

548. Sakashita, S. and Hayashi, C. (1961) Prog. Theor. Phys., 26, 942.
Internal Structure of Very Massive Stars.

See previous paper (Sakashita and Hayashi (1959)).

549. Savedoff, M. P. and van Dyck, S. R. (1959) Mem. Soc. R. Sci. Liege, 3, 523.
Early Evolution at Mass Ten.

Initial Composition:	X = .70, Y = .27, Z = .03.
Mass:	10 $M_\odot$ (E).
Construction Technique:	Fitting.
Equation of State:	Ideal gas, radiation pressure.
Energy Transfer:	Electron scattering plus Kramers opacity in radiative zones.
Energy Sources:	

550. Schwarzschild, M. and Härm, R. (1958) Ap. J., 128, 348.
Evolution of Very Massive Stars.

Initial Composition:	X = .75, Y = .22, Z = .03.
Mass:	28.2(E), 62.7(E), 121.1(E), 218.3(E) $M_\odot$.
Construction Technique:	Fitting.
Equation of State:	Ideal gas, radiation pressure.
Energy Transport:	electron scattering opacity in radiative zones; convective core - variable γ-radiation pressure included.
Energy Sources:	Carbon cycle-interpolation formula (B^2FH 1957).

551. Schwarzschild, M. and Selberg, H. (1962) Ap. J., 136, 150.
Red Giants of Population II. I

Initial Composition:	X = .900, Y = .099, Z = .001 X = 0, Y = .999, Z = .001 in core as the evolution begins.
Mass:	1.3 $M_\odot$ (E).
Construction Technique:	Ideal gas, complete degeneracy in core (abrupt transition).

Energy Transport: The degenerate core is isothermal; electron scattering plus Kramers opacity in radiative zones.

Energy Sources: pp cycle and Helium burning--interpolation formula. Gravitational Contraction in Later Stages.

552. Schwarzschild, M. and Härm, R. (1962) Ap. J., 136, 158.
Red Giants of Population II. II.
(Note in A. J., 66, 45).

Direct continuation of the paper above (Schwarzschild and Selberg 1962) through the Helium flash. Two interpolation formulae were used for the 3α reaction at different temperatures.

553. Sears, R. L. (1959) Ap. J., 129, 489.
An Evolutionary Sequence of Solar Models.

Initial Composition: X = .75, Y = .235, Z = .015 evolution is carried until X = .423 in the center.

Mass: 1 $M_\odot$ (E).

Construction Technique: Fitting.

Equation of State: Ideal gas.

Energy Transfer: Convective Envelope (adiabatic convection $P = KT^{2.5}$); opacity in the radiative core is an interpolative fit to Keller Meyerott (10%).

Energy Sources: pp chain ($He^3(He^3,2p)He^4$) interpolation formula to fit B^2FH 1957 .

554. Sears, R. L. (1961) Publ. Goethe Link Obs. #39.
An Evolutionary Sequence of Solar Models with Revised Nuclear Reaction Rates.

555. Sears, R. L. (1964) Ap. J., 140, 477.
Helium Content and Neutrino Fluxes in Solar Models.

Initial Composition: variable, X = .71, Y = .27, Z = .02 gives the best model for the sun.

Mass: 1 $M_\odot$ (E).

Construction Technique: Fitting.

Equation of State:	Ideal gas, partial degeneracy.
Energy Transport:	Convective envelope ($P = XT^{2.5}$ at boundary); Interior opacity is a fit to the opacity tables of Keller-Meyerott (as in Iben and Ehrman 1962); Conduction has been included.
Energy Sources:	Gravitational contraction; pp, CN chains - interpolation formula to fit Fowler 1960, Parker, Bahcall, Fowler 1964.

556. Shimoda, M. and Obi, S. (1958) Pub. Astr. Soc. Japan, 10, 26.
Studies on Stellar Models with Partially Degenerate Cores and Outer convective Zones.

Initial Composition:	$X = .9$, $Y = .1$ in convective envelope and radiative intermediate zone ($X_{CN} = .0005$ or $.005$); $X = 0$, $Y = 1$ in isothermal core.
Mass:	I. ($X_{CN} = .0005$) 2.48, 1.48, .94, .58, .62, .99, 2.83, 2.20, 1.82, 1.09, 1.07, 1.26, 1.60, 2.49, 2.28, 2.29, 3.11 $M_{\odot}$. II. ($X_{CN} = .005$) 2.20, 1.31, .84, .53, .56, .88, 2.52, 1.94, 1.61, .97, .96, 1.13, 1.43, 2.22, 2.03, 2.04, 2.78 $M_{\odot}$.
Construction Technique:	Fitting.
Equation of State:	Ideal gas, partially degenerate electrons.
Energy Transport:	Electron scattering opacity in radiative zones; $p = E\ t^{2.5}$ in convective envelope.
Energy Sources:	CN cycle in shell outside core, ρT^{15} interpolation formula.

557. Smak, J. (1960) Acta Astronomica, 10, 153.
Population II Stars. I Homogeneous Stellar Models with Convective Envelopes.

558. Stothers, R. (1963) Ap. J., 138, 1074.
Evolution of O Stars, I. Hydrogen Burning.

Initial Composition:	$X = .70$, $Y = .27$, $Z = .03$, $X_{CN} = Z/2$ throughout. Carried to the point where $X = .07$ in the core.
Mass:	30 $M_{\odot}$ (E).
Construction Technique:	Fitting.

Equation of State: Ideal gas, radiation pressure.

Energy Transport: Electron scattering radiative opacity. Adiabatic convection in the core.

Energy Sources: Full CNO cycle - interpolation formula to Reeves 1963 good to 15% - sources restricted to the core.

559. Stothers, R. (1964) Ap. J., 140, 510.
Evolution of O Stars, II. Hydrogen Exhaustion and Gravitational Contraction.

As above (Stothers 1963) except gravitational contraction is added as an energy source when the hydrogen becomes exhausted in the core.

560. Stothers R. (1966) Ap. J., 143, 91.
Evolution of O Stars, III. Helium Burning.

As above (Stothers, 1963, 1964). The distribution of energy sources varies in the Helium ignition, helium depletion and Helium exhaustion phases. Helium burning is added as an energy source.

561. Stothers, R. (1966) Ap. J., 144, 959.
The Semi-Convective Zone in Very Massive Stars.

As above (Stothers 1963-1966). The extent of the semi-convective zone and convective core are investigated during hydrogen burning.

Initial Composition: $X = .70$, $Z = .03$, $X_{CNO} = Z/2$.

Masses: 45, 60, 100, 200, 400, 1000 $M_{\odot}$.

562. Suda, K. and Hitotuyanagi,Z. (1960) Pub. Astr. Soc. Japan, 12, 21.
Stellar Models with Partially Degenerate Isothermal Cores.

Initial Composition: $X = .90$, $Y = .09$, $Z = .01$ in envelope. $X = 0$, $Y = .99$, $Z = .01$ in core.

Mass: 1(E), 1.2(E), 1.52(E), 2.0(E), 3.0(E), 4.0(E) $M_{\odot}$.

Construction Technique: Fitting.

Equation of State: Ideal gas, partially degenerate electrons.

Energy Transport: Kramers opacity in outer radiative zones.

Energy Sources: CN cycle alone in shell at interface.

563. Suda, K. and Virgopia, N. (1966) Ap. J., 143, 75.
On the Properties of Stellar Models with Double Energy Sources, I.

Initial (envelope) Composition:	I. $X = .900$, $Z = .001$, $X_{CNO} = (Z/7)/40$ II. $X = .80$, $Z = .001$, $X_{CNO} = (Z/7)/40$ III. $X = .9$, $Z = .001$, $X_{CNO} = (Z/2)/40$.
Masses:	I. 1.3, 1.0, .7 $M_{\odot}$; II. 1.3 $M_{\odot}$ III. 1.0 $M_{\odot}$.
Construction Technique:	Fitting.
Equation of State:	Ideal gas.
Energy Transport:	Opacity due to free-free transtions of H and He plus bound-free transitions of metalic ions in outer H envelope. Electron scattering opacity in the deeper envelope and intermediate radiative He zone; convective He core.
Energy Sources:	CNO cycle at bottom of H-rich envelope, 3α reaction in the core.

564. Tanaka, Y. (1966) Pub. Astr. Soc. Japan, 18, 47.
Evolution of Very Massive Stars with Mass Loss.

Initial Composition:	$X = .90$, $Z = .02$, $X_{CNO} = Z/3$.
Mass:	15.6, 46.8 $M_{\odot}$.
Construction Technique:	Fitting.
Equation of State:	Ideal gas, radiation pressure.
Energy Transport:	Electron scattering in radiative envelope; convective core.
Energy Sources:	CNO Cycle.

565. Uchida, J. (1958) Sci. Reports Tôhoku Univ., 41, 248.
Stellar Models with Isothermal Cores and Intermediate Convection Zones.

566. Van der Borght, R. and Meggitt, S. (1963) Austral. J. Phys., 16, 415.
Massive Stars with Uniform Composition.

Initial Composition:	Pure helium, or pure hydrogen.
Mass:	
Construction Technique:	Fitting, an approximate solution for massive stars with constant composition.

Equation of State: Ideal gas, radiation pressure.

Energy Transfer: Convection in core, electron scattering opacity in radiative zones.

Energy Sources: 3α interpolation formula for He model, pp, CN interpolation formula for "pure" hydrogen models.

567. Van der Borght, R. (1964) Austral. J. Physics, 17, 165.
The Evolution of Massive Stars Initially Composed of Pure Hydrogen.

Initial Composition: $X = 1$, $Y = Z = 0$, but there's already significant carbon by the time the model reaches the main sequence.

Mass: 40(E), 60(E), 80(E), 120(E) $M_{\odot}$.

Construction Technique: Fitting.

Equation of State: Ideal gas, radiation pressure.

Energy Transport: Electron scattering opacity in the radiative envelope.

Energy Sources: Gravitational in Pre M.S. contraction; pp, carbon cycles, 3α reaction (Ledoux, Rev. Ouest. Sci. 1961).

568. Varsavsky, C. M., Gratton, F. and Pöppel, W. G. L. (1962) Ann. d'Ap., 25, 261.
Some Models of Internal Structure of Subdwarfs.

Initial Composition:
1. $X = .7$, $Y = .3$, $Z < 10^{-4}$.
2. $X = .7$, $Y = .2965$, $Z < 10^{-4}$.
3. $X = .7$, $Y = .293$, $Z < 10^{-4}$, $X_C = .0035$.
4. $X = .7$, $Y = .299$, $Z = .001$,
5. $X = .7$, $Y = .292$, $Z = .001$, $X_C = .007$.
6. $X = .7$, $Y = .297$, $Z = .003$,
7. $X = .8$, $Y = .200$, $Z < 10^{-4}$.
8. $X = .8$, $Y = .196$, $Z < 10^{-4}$, $X_C = .004$.
9. $X = .8$, $Y = .192$, $Z < 10^{-4}$, $X_C = .008$.
10. $X = .99$, $Y = .01$, $Z < 10^{-4}$.

Mass: 0.7, 0.9, 1.1, 1.3, 1.5, 1.7 $M_{\odot}$.

Construction Technique: Fitting.

Equation of State: Ideal gas.

Energy Transport: Opacity is an interpolation to Keller-Meyerott (1955) or Reiz (1954) (12%) in radiative zones.

Energy Sources: CN cycle, pp chain-interpolation formula to B^2FH corrected for He abundance.

569. Virgopia, N. and Suda, K. (1966) Ap. J., 143, 87.
On the Properties of Stellar Models with Double Energy Sources, II. Stellar Models of 1.3 $M_{\odot}$ for Various CNO Contents.

Initial Composition:
1. $X = .9$, $Y = .099$, $Z = .001$, $X_{CNO} = Z/7$
2. $X = .9$, $Y = .099$, $Z = .001$, $X_{CNO} = (Z/7)/40$
3. $X = .9$, $Y = .09$, $Z = .01$, $X_{CNO} = Z/7$.

Mass: 1.3 $M_{\odot}$.

See Suda and Virgopia, 1966.

C. Commentary on Stellar Models and Stellar Evolution

570. Aller, L. H. (1959) Mem. Soc. R. Sci. Liege, 3, 41.
Nucleii of Planetary Nebula and the Late Stages of Stellar Evolution.

571. Aller, L. H. and Chapman, S. Y. (1960) Ap. J., 132, 461.
Diffusion in the Sun.

572. Anders, E. (1958) Ap. J., 127, 355.
A Time Scale for the Mixing Process in S-Type Stars.

573. Arpigne, C. (1963) Ap. J., 138, 607.
Approximate Evaluation of the Fermi-Dirac Functions.

574. Boury, A. (1963) Ann. d'Ap., 26, 354.
Stabilité et évolution dans le voisinage de la séquence principle d'étoiles massives formées à partir d'hydrogéne pur.

575. Boury, A. (1964) Ap. J., 140, 1322.
Effects of Non-Constant Scattering Opacity on Models for Massive Stars Initially Composed of Pure hydrogen.

576. Chiu, H. Y. (1966) in Stellar Evolution, R. F. Stein and A. G. W. Cameron, eds., 279.
Pre-Supernova Evolution (Neutrino Stars).

577. Cimino, M., Giannone, P., Giannuzzi, M. A., Masani, A. and Virgopia, N. (1964) Nuovo Cimento, 33, 663.
Neutrino Production in Massive Helium Star Models.

578. Crampin, J. (1961) M. N., 122, 17.
Semi Empirical Tracks for the Cluster M 67.

579. Demarque, P. (1962) A. J., 67, 270.
Evolution of Population II Stars.
(Abstract).

580. Demarque, P. (1966) in Stellar Evolution, R. F. Stein and A. G. W. Cameron, eds., 231.
Evolution of Stars Near One Solar Mass.

581. Dicke, R. H. (1966) in Stellar Evolution, R. F. Stein and A. G. W. Cameron, eds., 319.
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APPENDIX: TABLE OF STELLAR MODELS

$M/M_{\odot}$	Initial Composition	Reference	Date
<1.4	He^4, C^{12}, Mg^{24}, Si^{28}, S^{32}, or Fe^{56} plus an equilibrium composition of these	503, Hamada, et al.	1961
.04	I X = .90, Y = .009, Z = .01 II X = .62, Y = .35, Z = .03	530, Kumar	1963
.05		530, Kumar	1963
.06		530, Kumar	1963
.07		530, Kumar	1963
.08		530, Kumar	1963
.09		530, Kumar	1963
.0912	X = .75, Y = .23, Z = .02	532, Limber	1958
.10		532, Limber	1958
.11		532, Limber	1958
.126		532, Limber	1958
.158		532, Limber	1958
.162	X = .48, Y = .511, Z = .009	526, Kaminisi	1960
.209	X = .56, Y = .43, Z = .01 X = .50, Y = .47, Z = .03	526, Kaminisi	1960
.251	see above	532, Limber	1958
.269	X = .664, Y = .328, Z = .008 X = .500, Y = .471, Z = .029	526, Kaminisi	1960
.31 E	Y = 1	488, Cox, et al.	1964
.35	Y = 1	488, Cox, et al.	1964

.398	see p 94	532, Limber	1958
.40	$Y = 1$	488, Cox, et al.	1964
.4	$X = 0$, $Y = .999$, $Z = .001$	497, Divine	1965
.4	$Y = 1.0$	545, Rose	1966
.454	$X = 0$, $Y = 0$, $Z = 1$ with $X_c \sim .02$ to $.03$	490, Deinzer, et al.	1965
.4832	$Y = 1$	489, Deinzer, et al.	1964
.499	see above	490, Deinzer, et al.	1965
.5	$Y = 1$	486, Cox, et al.	1961
.5	$Y = 1$	487, Cox, et al.	1961
.5 E	$Y = 1$	488, Cox, et al.	1964
.5 E	$X = .38$, $Z = .015$	482, Bodenheimer	1965
.5 E	see above	497, Divine	1965
.5	$Y = 1.0$	545, Rose	1966
.53	$X = .9$, $Y = .1$ in convective envelope and radiative in intermediate zone $X = 0$, $Y = 1$ in isothermal core $X_{CN} = .005$	556, Shimoda, et al.	1958
.56	$X_{CN} = .005$ see above	556, Shimoda, et al.	1958
.58	$X_{CN} = .0005$ see above	556, Shimoda, et al.	1958
.59 E	$X = .38$, $Z = .015$	482, Bodenheimer	1965
.6	$X = .999$, $Z = .001$ or $.01$ $X = .75$, $Z = .001$ or $.01$ $X = .75$, $Z = .005$	491, Demarque 492,	1960
.6	see 492, Demarque 1960	493, Demarque	1961
.62	$X_{CN} = .005$ see above	556, Shimoda, et al.	1958
.620	$X = 0$, $Y = .999$, $Z = .001$	497, Divine	1965
.631	$X = .75$, $Y = .23$, $Z = .02$	532, Limber	1958

.65 E	$X = .65$, $X_{CNO} = Z/2 = 10^{-3}$, 10^{-4}, 10^{-5}	501, Faulkner, et al.	1966
.68 E	$X = .38$, $Z = .015$	482, Bodenheimer	1965
.7	I $X = .7$, $Y = .3$, $Z < 10^{-4}$ $X_C = 0$ II $X = .7$, $Y = .2965$, $Z < 10^{-4}$, $X_C = 0$ III $X = .7$, $Y = .293$, $Z < 10^{-4}$, $X_C = .0035$ IV $X = .7$, $Y = .299$, $Z = .001$, $X_C = 0$ V $X = .7$, $Y = .292$, $Z = .001$, $X_C = .007$ VI $X = .7$, $Y = .297$, $Z = .003$, $X_C = 0$ VII $X = .8$, $Y = .20$, $Z < 10^{-4}$, $X_C = 0$ VIII $X = .8$, $Y = .196$, $Z < 10^{-4}$, $X_C = .004$ IX $X = .8$, $Y = .192$, $Z < 10^{-4}$, $X_C = .008$ X $X = .99$, $Y = .01$, $Z < 10^{-4}$, $X_C = 0$	568, Varsavsky, et al.	1962
.7 E	$X = .90$, $Y = .10$, $Z = .001$	510, Hayashi, et al.	1962
.7 E	$X = .90$, $Y = .10$, $Z = .001$, $X_{CN} = Z/2$	513, Hayashi, et al.	1965
.7	Envelope: $X = .9$, $Y = .099$, $Z = .001$, $X_{CN} = (Z/7)/40$ Core: $X = 0$, $Y = .999$, $Z = .001$	563, Suda, et al.	1966
.70 E	$X = .65$, $X_{CNO} = Z/2 = 10^{-3}$, 10^{-4} 10^{-5} $X = .90$, $X_{CNO} = Z/2 = 10^{-4}$	501, Faulkner, et al.	1966
.718	$X = 0$, $Y = 0$, $Z = 1$, $X_{CN} \sim .02$ or $.03$	490, Deinzer, et al.	1965
.71	$Y = 1$	488, Cox, et al.	1964

.75 E	$X = .65$, $X_{CNO} = Z/2 = 10^{-3}$, 10^{-4}, 10^{-5} $X = .90$, $X_{CNO} = Z/2 = 10^{-4}$	501, Faulkner, et al.	1966
.75	$Y = 1.0$	545, Rose	1966
.765	see p 95	497, Divine	1965
.796	see p 95	490, Deinzer, et al.	1965
.8	see p 95	491, Demarque 492,	1960
.8	see p 95	493, Demarque	1961
.8 E	I $Y = 1$ II $Y = 1$ for $0 \leq M_r/M \leq .85$ III $Y = 1$ for $0 \leq M_r/M \leq .8$ II, $X = .9$, $Y = .099$, $Z = .001$ III in envelope	538, Osaki	1963
.8	$X = .57$ or $.77$, $Z = .03$	495, Demarque, et al.	1964
.8 E	$X = .67$, $Z = .03$	495, Demarque, et al.	1964
.8 E	$X = .66$, $Z = .0264$	482, Bodenheimer	1965
.8	see p 95	497, Divine	1965
.819	see p 95	490, Deinzer, et al.	1965
.84	$X_{CN} = .005$ see p 95	556, Shimoda, et al.	1958
.865	$X = .6$, $Z = .02$, $X_{CN} = .18Z$	520, Iben et al.	1962
.872	see p 95	490, Deinzer, et al.	1965
.88	$X_{CN} = .005$ see p 95	556, Shimoda, et al.	1958
.886	$X = .7$, $Z = .02$, $X_{CN} = .18\ Z$	520, Iben, et al.	1962
.9	see p 96	568, Varsavsky, et al.	1962
.9	$X = .57$ or $.77$, $Z = .03$	495, Demarque, et al.	1964
.9 E	$X = .67$, $Z = .03$	495, Demarque, et al.	1964
.9	$X = .6$, $Z = .02$, $X_{CN} = .19\ Z$	539, Pearce, et al.	1965
.910	see above	539, Pearce, et al.	1965

.915	see p 97	539, Pearce, et al.	1965
.920	see p 97	539, Pearce, et al.	1965
.925	see p 97	539, Pearce, et al.	1965
.930	see p 97	539, Pearce, et al.	1965
.94	X_{CN} = .0005 see p 95	556, Shimoda, et al.	1958
.940	see p 97	539, Pearce, et al.	1965
.950	see p 97	539, Pearce, et al.	1965
.96	X_{CN} = .005 see p 95	556, Shimoda, et al.	1958
.963	X = 0, Y = 0, Z = 1, $X_{CN} \sim$ .02 or .03	490, Deinzer, et al.	1965
.97	X_{CN} = .005 see p 95	556, Shimoda, et al.	1958
.9844	Y = 1.0	489, Deinzer, et al.	1964
.987	X = .75, Y = .249, Z = .001	506, Haselgrove, et al.	1959
.99	X_{CN} = .0005 see p 95	556, Shimoda, et al.	1958
1.0	X = .75, Y = .23, Z = .02	532, Limber	1958
1.0 E	X = .76, Y = .2375, Z = .0025 X = .85, Y = .1475, Z = .0025 X = .93, Y = .0675, Z = .0025 X = .99, Y = .0075, Z = .0025 Z is all C-N	480, Blackler	1958
1.0 E	X = .75, Y = .235, Z = .015	553, Sears	1959
1.0	see p 95	491, Demarque 492,	1960
1.0	X = .995, Y = .003, Z = .002	533, Massevich, et al.	1960
1.0 E	X = .90, Y = .09, Z = .01 (envelope) X = 0, Y = .99, Z = .01 (core)	562, Suda, et al	1960
1.0	Y = 1	486, Cox, et al.	1961
1.0	Y = 1	487, Cox, et al.	1961

1.0	see 492, Demarque 1960 p 95	493, Demarque	1961
1.0	X = 1	498, Ezer	1961
1.0	Y = .999, Z = .001	537, Oke	1961
1.0 E	X = .999, Y = 0, Z = .001	494, Demarque, et al.	1963
1.0 E	Y = 1	488, Cox, et al.	1964
1.0 E	Z = .02 for X = .78, .76, .74, .72, .70 Z = .025 for X = .74, .72, .70, .68, .66 Z = .030 for X = .72, .70, .68, .66, .64 Z = .035 for X = .70, .68, .66, .64 Z = .040 for X = .68, .66, .64	496, Demarque, et al.	1964
1.0	X = .57 or .77, Z = .03	495, Demarque, et al.	1964
1.0 E	X = .67, Z = .03	495, Demarque, et al.	1964
1.0	X = .68, Y = .276, Z = .044, X_{CN} = .0091	540, Pochoda, et al.	1964
1.0 E	$.68 \leq X \leq .81$, Z = .04	541, Pochoda, et al.	1964
1.0 E	X = .90, Y = .099, Z = .001	504, Härm, et al.	1964
1.0 E	Variable-X = .71, Y = .27 Z = .02 gives best model	535, Sears	1964
1.0		544, Rouse (abstract)	1965
1.0 E	X = .739, Y = .240, Z = .021 $X_C = 4.618 \times 10^{-3}$, $X_N = .97 \times 10^{-3}$, $X_O = 1.0715 \times 10^{-2}$	499, Ezer, et al.	1965
1.00	X = .6, Z = .02, X_{CN} = .19 Z	539, Pearce, et al.	1965
1.0 E	X = .66, Z = .0264	482, Bodenheimer	1965
1.0 E	X = 0, Y = .999, Z = .001	497, Divine	1965
1.0	see p 96	563, Suda, et al.	1966
1.0	X = .9, Y = .099, Z = .001 X_{CNO} = (Z/2)/40	563, Suda, et al.	1966

1.0 E	$X = .65$, $X_{CNO} = Z/2 = 10^{-3}$, 10^{-4}, 10^{-5} $X = .90$, $X_{CNO} = Z/2 = 10^{-4}$	501, Faulkner, et al.	1966
	population II stars	557, Smak	1960
1.01	$X = .75$, $Y = .24$, $Z = .01$	506, Haselgrove, et al.	1959
1.02	$X = .75$, $Y = .249$, $Z = .001$	506, Haselgrove, et al.	1959
1.05	$X = .7$, $Z = .02$, $X_{CN} = .18\ Z$	520, Iben, et al.	1962
1.05	$X = .7$, $Z = .01$ $X_{CN} = .19\ Z$	539, Pearce, et al.	1965
1.06	$X = .99$, $Y = .009$, $Z = .001$	506, Haselgrove, et al.	1959
1.06	see above (1.05)	539, Pearce, et al.	1965
1.07	$X = .7$, $Z = .01$, $X_{CN} = .18\ Z$	520, Iben, et al.	1962
1.07	$X_{CN} = .0005$ see p 95	556, Shimoda, et al.	1958
1.07	see above (1.05)	539, Pearce, et al.	1965
1.08	see above (1.05)	539, Pearce, et al.	1965
1.085	see above (1.05)	539, Pearce, et al.	1965
1.09	$X_{CN} = .0005$ see p 95	556, Shimoda, et al.	1958
1.09	$X = .75$, $Y = .24$, $Z = .01$	506, Haselgrove, et al.	1959
1.09 E	$X = .75$, $Y = .24$, $Z = .01$	518, Hoyle	1959
1.09	see above (1.05)	539, Pearce, et al.	1965
1.095	see above (1.05)	539, Pearce, et al.	1965
1.10	see p 96	568, Varsavsky, et al.	1962
1.10	$X = .57$, $.67$, or $.77$, $Z = .03$	495, Demarque, et al.	1964
1.10	$X = .7$, $Z = .01$, $.02$, $X_{CN} = .19\ Z$	539, Pearce, et al.	1965
1.110	$X = .7$, $Z = .02$, $X_{CN} = .19\ Z$	539, Pearce, et al.	1965
1.112	$X = .75$, $Z = .015$, $X_{CN} = .18\ Z$	520, Iben, et al.	1962
1.120	see above (1.110)	539, Pearce, et al.	1965

1.13	X_{CN} = .005, see p 95	556, Shimoda, et al.	1958
1.13	see p 100 (1.110)	539, Pearce, et al.	1965
1.135	see p 100 (1.110)	539, Pearce, et al.	1965
1.140	see p 100 (1.110)	539, Pearce, et al.	1965
1.150	see p 100 (1.110)	539, Pearce, et al.	1965
1.16 E	X = .75, Y = .249, Z = .001	518, Hoyle	1959
1.17	X = .75, Y = .249, Z = .001	506, Haselgrove, et al.	1959
1.175	X = .8, Z = .01	520, Iben, et al.	1962
1.19	X = .75, Y = .24, Z = .01	506, Haselgrove, et al.	1959
1.2 E	X = .9, Y = .1, X_{CN} = .0005	527, Kippenhahn, et al.	1958
1.20	X = .99, Y = .009, Z = .001	506, Haselgrove, et al.	1959
1.2 E	see p 96	562, Suda, et al.	1960
1.20 E	X = .999, Y = 0, Z = .001 X = .99, Y = 0, Z = .01 X = 1., Y = 0, Z = 0 X = .749, Y = .25, Z = .001	494, Demarque, et al.	1963
1.2	X = .57, .67, .77, Z = .03	495, Demarque, et al.	1964
1.20	X = .8, Z = .02 X = .8, (X_{CN} = .19 Z), Z = .01 X = .7, Z = .02	539, Pearce, et al.	1965
1.2 E	X = .66, Z = .0264	482, Bodenheimer	1965
1.2 E	X = .899, Y = .100, Z = .001 X = .891, Y = .099, Z = .01	531, Kung, et al.	1965
1.21	X = .6, Z = .02	520, Iben, et al.	1962
1.25	X = .99, Y = .009, Z = .001	506, Haselgrove, et al.	1959
1.25	X = .8, Z = .02	520, Iben, et al.	1962
1.25	Y = 1.0	488, Cox, et al.	1964
1.250	X = .8, Z=.02,.01 X = .7, (X_{CN} = .19 Z),Z=.02,.01 X = .6, Z=.02	539, Pearce, et al.	1965

1.25	$X = 0,\ Y = .999,\ Z = .001$	497, Divine	1965
1.25	$X = .9, .65,$ $X_{CNO} = .5Z = 10^{-5}, ^{-4}, ^{-3}, ^{-2}$	500, Faulkner	1966
1.25 E	$X = .65,\ X_{CNO} = .5Z = 10^{-3}, ^{-4}, ^{-5}$ $X = .90,\ X_{CNO} = .5Z = 10^{-4}, ^{-5}$	501, Faulkner, et al.	1966
1.256	$X = .7,\ Z = .02$	520, Iben, et al.	1962
1.26	$X_{CN} = .0005$ see p 95	556, Shimoda, et al.	1958
1.27 E	$X = .9309,\ Y = .0666,\ Z = .0025$	505, Haselgrove, et al.	1958
1.29	$X = .75,\ Y = .24,\ Z = .01$	506, Haselgrove, et al.	1959
1.30 E	$X = .90,\ Y = .099,\ Z = .001$	551, Schwarzschild, et al.	1962
1.30 E	$X = .75,\ Y = .22,\ Z = .03$	552, Schwarzschild, et al.	1962
1.3	see p 96	558, Varsavsky, et al.	1962
1.3	$X = .57, .67, .77,\ Z = .03$	495, Demarque, et al.	1964
1.3 E	$X = .90,\ Y = .099,\ Z = .001$ $X = .90,\ Y = .090,\ Z = .01$	504, Härm, et al.	1964
1.30	$X = .8,\ Z = .02, .01,\ X_{CN} = .19\ Z$	539, Pearce, et al.	1965
1.3	see p 96, also $X = .8,\ Z = .001$ $X_{CNO} = (Z/7)/40$	563, Suda, et al.	1966
1.3	$X = .9,\ Z = .01, .001,$ $X_{CNO} = Z/7$ $X = .9,\ Z = .01,$ $X_{CNO} = (Z/7)/40$	569, Virgopia, et al.	1966
1.303	$X = .6,\ Z = .02,\ X_{CN} = .18\ Z$	520, Iben, et al.	1962
1.31	$X_{CNO} = .005$, see p 95	556, Shimoda, et al.	1958
1.310	$X = .8,\ Z = .01,\ X_{CN} = .19\ Z$	539, Pearce, et al.	1965
1.315	see above (1.31)	539, Pearce, et al.	1965
1.320	see above (1.31)	539, Pearce, et al.	1965
1.330	see above (1.31)	539, Pearce, et al.	1965

1.34	X = .75, Y = .249, Z = .001	506, Haselgrove, et al.	1959
1.340	see p 102 (1.31)	539, Pearce, et al.	1965
1.35	X = .99, Y = .009, Z = .001	506, Haselgrove, et al.	1959
1.35 E	X = .99, Y = .009, Z = .001	518, Hoyle	1959
1.350	X = .8, Z = .02,.01, X_{CN} = .19 Z	539, Pearce, et al.	1965
1.354	X = .7, Z = .02	520, Iben, et al.	1962
1.360	X = .8, Z = .02, X_{CN} = .19 Z	539, Pearce, et al.	1965
1.365	see above (1.360)	539, Pearce, et al.	1965
1.370	see above (1.360)	539, Pearce, et al.	1965
1.380	see above (1.360)	539, Pearce, et al.	1965
1.390	see above (1.360)	539, Pearce, et al.	1965
1.40	X = .75, Y = .24, Z = .01	506, Haselgrove, et al.	1959
1.40	X = .8, Z = .02,.01, X_{CN} = .19 Z	539, Pearce, et al.	1965
1.420	X = .8, Z = .01, X_{CN} = .18 Z	520, Iben, et al.	1962
1.43	X_{CN} = .005 see p 95	556, Shimoda, et al.	1958
1.43	X = .75, Y = .249, Z = .001	506, Haselgrove, et al.	1959
1.44	X = .75, Z = .015,X_{CN} = .18 Z	520, Iben, et al.	1962
1.45	see above (1.360)	539, Pearce, et al.	1965
1.46	X = .75, Y = .24, Z = .01	506, Haselgrove, et al.	1959
1.47	X = .99, Y = .009, Z = .001	506, Haselgrove, et al.	1959
1.47	X = .7, Z = .01, X_{CN} = .18 Z	520, Iben, et al.	1962
1.48	X_{CN} = .0005 see p 95	556, Shimoda, et al.	1958
1.48	X = .73, Y = .25, Z = .02	479, Bennick, et al.	1965
1.5 E	X = .68, Y = .31, Z = .01	514, Henyey, et al.	1959
1.5	see p 96	568, Varsavsky, et al.	1962

1.5	$Y = 1.0$	488, Cox, et al.	1964
1.5	$X = .7,.8,\ Z = .02,.01$ $X = .6,\quad Z = .02$ $X_{CN} = .19\ Z$	539, Pearce, et al.	1965
1.5	$X = 0,\ Y = .999,\ Z = .001$	497, Divine	1965
1.506	$X = .7,\ Z = .02,\ X_{CN} = .18\ Z$	520, Iben, et al.	1962
1.52	$X = .75,\ Y = .24,\ Z = .01$ $X = .75,\ Y = .249,\ Z = .001$	506, Haselgrove, et al.	1959
1.52 E	$X = .75,\ Y = .23,\ Z = .02$	519, Hoyle	1960
1.52 E	see p 96	562, Suda, et al.	1960
1.538	$X = 0,\ Y = 0,\ Z = 1,$ $X_C \sim .02$ or $.03$	490, Deinzer, et al.	1965
1.563	$X = .6,\ Z = .02,\ X_{CN} = .18\ Z$	520, Iben, et al.	1962
1.581	$X = .8,\ Z = .02,\ X_{CN} = .18\ Z$	520, Iben, et al.	1962
1.596	$X = .75,\ Z = .015,\ X_{CN} = .18\ Z$	520, Iben, et al.	1962
1.6	$X_{CN} = .0005$ see p 95	556, Shimoda, et al.	1958
1.6	$X = .99,\ Y = .009,\ Z = .001$	506, Haselgrove, et al.	1959
1.6	see p 102 (1.31)	539, Pearce, et al.	1965
1.61	$X_{CN} = .005$ see p 95	556, Shimoda, et al.	1958
1.61	$X = .75,\ Y = .249,\ Z = .001$	506, Haselgrove, et al.	1959
1.623	$X = 0,\ Y = 0,\ Z = 1,\ X_C \sim .02$ to $.03$	490, Deinzer, et al.	1965
1.645	see above	490, Deinzer, et al.	1965
1.7	see p 96	568, Varsavsky, et al.	1962
1.706	$X = .8,\ Z = .01,\ X_{CN} = .18\ Z$	520, Iben, et al.	1962
1.74	$X = .99,\ Y = .009,\ Z = .001$	506, Haselgrove, et al.	1959
1.750	$X = .8,.7,\ Z = .02,.01$ $X = .6,\quad Z = .02$ $X_{CN} = .19\ Z$	539, Pearce, et al.	1965

1.794	$X = .8$, $Z = .02$, $X_{CN} = .18\ Z$	520, Iben, et al.	1962
1.811	$X = .7$, $Z = .01$, $X_{CN} = .18\ Z$	520, Iben, et al.	1962
1.82 E	$\mu_i/\mu_c = 1.0, 1.5788, 2.5, 2.6667$	515, Hitotuyanagi, et al.	1958
1.82	$X_{CN} = .0005$ see p 95	556, Shimoda, et al.	1958
1.86	$X = .6$, $Z = .02$, $X_{CN} = .18\ Z$	520, Iben, et al.	1962
1.866	$X = .7$, $Z = .02$, $X_{CN} = .18\ Z$	520, Iben, et al.	1962
1.87	$X = .75$, $Z = .015$, $X_{CN} = .18\ Z$	520, Iben, et al.	1962
1.94	$X_{CN} = .005$ see p 95	556, Shimoda, et al.	1958
1.94	$X = .75$, $Y = .249$, $Z = .001$	506, Haselgrove, et al.	1959
1.97	$X = .75$, $Y = .24$, $Z = .01$	506, Haselgrove, et al.	1959
2.0 E	see p 98	480, Blackler	1958
2.0 E	$X = .68$, $Y = .31$, $Z = .01$	514, Henyey, et al.	1959
2.0 E	see p 96	562, Suda, et al.	1960
2.0	$Y = 1$	486, Cox et al.	1961
2.0	$Y = 1$	487, Cox, et al.	1961
2.0	$X = 1$	498, Ezer	1961
2.0 E	$Y = 1$	488, Cox, et al.	1964
2.0	$X = .596$, $Z = .02$	476, Auman, et al.	1965
2.00	see p 104 (1.75)	539, Pearce, et al.	1965
2.0 E	$X = .596$, $Z = .02$, $X_{CN} = .20\ Z$	477, Auman	1965
2.0	$X = 0$, $Y = .999$, $Z = .001$	497, Divine	1965
2.02	$X = .8$, $Z = .01$, $X_{CN} = .18\ Z$	520, Iben, et al.	1962
2.03	$X_{CN} = .005$ see p 95	556, Shimoda, et al.	1958
2.04	$X_{CN} = .005$ see p 95	556, Shimoda, et al.	1958
2.07	$X = .99$, $Y = .009$, $Z = .001$	506, Haselgrove, et al.	1959
2.10	$X = .8$, $Z = .02$, $X_{CN} = .18\ Z$	520, Iben, et al.	1962

2.135	$X = .75$, $Z = .015$, $X_{CN} = .18\ Z$	520, Iben, et al.	1962
2.172	$X = .7$, $Z = .01$, $X_{CN} = .18\ Z$	520, Iben, et al.	1962
2.20	$X_{CN} = .005, .0005$ see p 95	556, Shimoda, et al.	1958
2.22	$X_{CN} = .005$ see p 95	556, Shimoda, et al.	1958
2.26	$X = .6$, $Z = .02$, $X_{CN} = .18\ Z$	520, Iben, et al.	1962
2.28	$X_{CN} = .0005$ see p 95	556, Shimoda, et al.	1958
2.280	$X = .7$, $Z = .02$, $X_{CN} = .18\ Z$	520, Iben, et al.	1962
2.29	$X_{CN} = .0005$ see p 95	556, Shimoda, et al.	1958
2.292	$Y = 1$	489, Deinzer, et al.	1964
2.3 E	I-$C^{12} = .0042$, $C^{13} = 5.4(-5)$, $N = 1.45(-3)$, $O = 1.31(-2)$ II-$C^{12} = .0016$, $C^{13} = 5.4(-5)$, $N = 5.49(-3)$, $O = 1.31(-2)$ III-$C^{12} = .0016$, $C^{13} = 5.4(-5)$, $N = 1.359(-2)$, $O = 5(-3)$. IV-$C^{12} = .0028$, $C^{13} = 3.6(-5)$, $N = 9.67(-4)$, $O = 8.74(-3)$. $X = .68$, $Y = .29$ for all 4 cases	481, Bodenheimer, et al.	1965
2.32	$X = .8$, $Z = .01$, $X_{CN} = .18\ Z$	520, Iben, et al.	1962
2.43	$X = .75$, $Y = .249$, $Z = .001$	506, Haselgrove, et al.	1959
2.46	$X = .99$, $Y = .009$, $Z = .001$	506, Haselgrove, et al.	1959
2.48	$X_{CN} = .0005$ see p 95	556, Shimoda, et al.	1958
2.49	$X_{CN} = .0005$ see p 95	556, Shimoda, et al.	1958
2.5	$X = .7$, $Y = .28$, $Z = .02$, $X_{CN} = .19\ Z$	478, Bahng	1964
2.5	$X = .596$, $Z = .02$	476, Auman, et al.	1965
2.52	$X_{CN} = .005$ see p 95	556, Shimoda, et al.	1958
2.63	$X = .8$, $Z = .02$, $X_{CN} = .18\ Z$	520, Iben, et al.	1962
2.68	$X = .99$, $Y = .009$, $Z = .001$	506, Haselgrove, et al.	1959

2.78	X_{CN} = .005 see p 95	556, Shimoda et al.	1958
2.83	X_{CN} = .0005 see p 95	556, Shimoda et al.	1958
2.850	X = .8, Z = .01, X_{CN} = .18 Z	520, Iben, et al.	1962
2.864	X = .7, Z = .02, X_{CN} = .18 Z	520, Iben, et al.	1962
2.89	X = .75, Y = .24, Z = .01	506, Haselgrove, et al.	1959
2.9	X = 0, Y = .98, Z = .02	485, Cimino, et al.	1963
2.9 E	X = 0, Y = .98, Z = .02	502, Giannone, et al.	1965
2.91	X = .99, Y = .009, Z = .001	506, Haselgrove, et al.	1959
3.0 E	see p 96	562, Suda, et al.	1960
3.0	Y = 1.0	486, Cox, et al.	1961
3.0	Y = 1.0	487, Cox, et al.	1961
3.0	X = 0, Y = .999, Z = .001	497, Divine	1965
3.0 E	X = .708, Z = .02	521, Iben	1965
3.05	X = .75, Y = .249, Z = .001	506, Haselgrove, et al.	1959
3.078	X = .75, Z = .015, X_{CN} = .18 Z	520, Iben, et al.	1962
3.11	X_{CN} = .0005 see p 95	556, Shimoda, et al.	1958
3.44	X = .75, Y = .24, Z = .01	506, Haselgrove, et al.	1959
3.47	X = .99, Y = .009, Z = .001	506, Haselgrove, et al.	1959
3.5 E	X = .68, Y = .31, Z = .01	514, Henyey, et al.	1959
3.5	X = .596, Z = .02	476, Auman, et al.	1965
3.89 E	X = .75, Y = .23, Z = .02	519, Hoyle	1960
3.90	X = .75, Y = .24, Z = .01	506, Haselgrove, et al.	1959
3.986 E	Y = 1.0	489, Deinzer, et al.	1964
4.0 E	see p 98	480, Blackler	1958
4.0	X = .99, Y = .009, Z = .001	506, Haselgrove, et al.	1959
4.0 E	see p 96	562, Suda, et al.	1960

4.0	$Y = 1.0$	486, Cox, et al.	1961
4.0	$Y = 1.0$	487, Cox, et al.	1961
4.0 E	$X = .61$, $Y = .37$, $Z = .02$, $X_{CNO} = .008$	509, Hayashi, et al.	1962
4.0 E	$X = .61$, $Y = .37$, $Z = .02$ $X_{CNO} = .008$	510, Hayashi, et al.	1962
4.0	$Y = 1.0$	488, Cox, et al.	1964
4.0	$X = 0$, $Y = .999$, $Z = .001$	497, Divine	1965
5.0	$Y = 1.0$	486, Cox, et al.	1961
5.0	$Y = 1.0$	487, Cox, et al.	1961
5.0	$X = 1.0$	498, Ezer	1961
5.0 E	$X = .74$, $Y = .24$, $Z = .02$, $X_{CN} = Z/7$	542, Polak	1962
5.0	$X = .596$, $Z = .020$	476, Auman, et al.	1965
5.0 E	$X = .602$, $Y = .354$, $Z = .044$	528, Kippenhahn, et al.	1965
5.0 E	$X = .708$, $Z = .02$	522, Iben	1966
5.22	$X = 0$, $Y = 0$, $Z = 1$, $X_C \sim .02$, to $.03$	490, Deinzer, et al.	1965
5.5	$Y = .98$, $Z = .02$	485, Cimino, et al.	1963
5.58	see above	490, Deinzer, et al.	1965
5.97	$X = .75$, $Y = .24$, $Z = .01$	506, Haselgrove, et al.	1959
6.0 E	$X = .68$, $Y = .31$, $Z = .01$	514, Henyey, et al.	1959
6.0	$Y = 1.0$	486, Cox, et al.	1961
6.0	$Y = 1.0$	487, Cox, et al.	1961
6.0 E	$X = 0$, $Y = .999$, $Z = .001$	497, Divine	1965
6.0 E	$X = .70$, $Z = .03$, $X_{CNO} = .6\ Z$	543, Reiz, et al.	1966
6.588	$Y = 1.0$	489, Deinzer, et al.	1964
7.0	$Y = 1.0$	486, Cox, et al.	1961

7.0	$Y = 1.0$	487, Cox, et al.	1961
7.0 E	$X = .602,\ Y = .354,\ Z = .044$	516, Hofmeister, et al.	1964
7.0 E	$X = .602,\ Y = .354,\ Z = .044$	517, Hofmeister, et al.	1964
8.0 E	see p 98	480, Blackler,	1958
8.0	$Y = 1.0$	486, Cox, et al.	1961
8.0	$Y = 1.0$	487, Cox, et al.	1961
8.0	$Y = 1.0$	488, Cox, et al.	1964
8.0	$X = 0,\ Y = .999,\ Z = .001$	497, Divine	1965
8.94 E	$X = .75,\ Y = .23,\ Z = .02$	519, Hoyle	1960
8.95	$X = .75,\ Y = .24,\ Z = .01$	506, Haselgrove, et al.	1959
9.0	$Y = 1.0$	486, Cox, et al.	1961
9.0	$Y = 1.0$	487, Cox, et al.	1961
9.0	$Y = .98,\ Z = .02$	485, Cimino, et al.	1963
9.0 E	$X = .708,\ Z = .02$	523, Iben	1966
9.97	$X = 0,\ Y = 0,\ Z = 1,$ $X_C \sim .02$ to $.03$	490, Deinzer, et al.	1965
10.0 E		525, Iinuma	1959
10 E	$X = .70,\ Y = .27,\ Z = .03$	549, Savedoff, et al.	1959
10.0	$X = 1$	498, Ezer	1961
10.0	$X = 0,\ Y = .999,\ Z = .001$	497, Divine	1965
10.0 E	$X = .70,\ Z = .03,\ X_{CNO} = .6\ Z$	543, Reiz, et al.	1966
10.1 E	$X = .61,\ Y = .37,\ Z = .02,$ $X_{CNO} = Z/3$	511, Hayashi, et al.	1962
11.0 E	$X = .68,\ Y = .31,\ Z = .01$	514, Henyey, et al.	1959
12.5	$X = 0,\ Y = .999,\ Z = .001$	497, Divine	1965
13.4	$X = .75,\ Y = .24,\ Z = .01$	506, Haselgrove, et al.	1959
14.6	$Y = .98,\ Z = .02$	485, Cimino, et al.	1963

14.6 E	$Y = .98,\ Z = .02$	502, Giannone, et al.	1965
14.8 E	$Y = 1.0$	489, Deinzer, et al.	1964
14.8	$Y = .999,\ Z = .001$	497, Divine	1965
15.0 E	$X = .708,\ Z = .02$	524, Iben	1966
15.0 E	$X = .70,\ Z = .03,\ X_{CNO} = .6\ Z$	543, Reiz, et al.	1966
15.6 E	$X = .90,\ Y = .08,\ Z = .02,$ $X_{CNO} = Z/3$	546, Sakashita, et al.	1959
15.6 E	$X = .90,\ Y = .08,\ Z = .02$ $X_{CN} = Z/3$	507, Hayashi, et al.	1959
15.6 E		510, Hayashi, et al.	1962
15.6 E	$X = .90,\ Y = .08,\ Z = .02$ $X_{CNO} = Z/3$	511, Hayashi, et al.	1962
15.6	$X = .90,\ Y = .08,\ Z = .02$ $X_{CNO} = Z/3$	564, Tanaka	1966
15.6 E	$X = .90,\ Z = .02,\ X_{CNO} = Z/7$	529, Kotok	1966
16.0 E	see p 98	480, Blackler	1958
19.4	$X = 0,\ Y = 0,\ Z = 1,$ $X_C \sim .02$ to $.03$	490, Deinzer, et al.	1965
20 E	$X = .68,\ Y = .31,\ Z = .01$	514, Henyey, et al.	1959
20	$X = 1$	498, Ezer	1961
20.0	$Y = .999,\ Z = .001$	497, Divine	1965
20.0 E	$X = .70,\ Z = .05,\ X_{CNO} = Z/7$	529, Kotok	1966
20.1	$X = .75,\ Y = .24,\ Z = .01$	506, Haselgrove, et al.	1959
24.3	$Y = .98,\ Z = .02$	485, Cimino, et al.	1963
26.73	$Z = 1,\ X_C \sim .02$ to $.03$	490, Deinzer, et al.	1965
27.2	$Z = 1,\ X_C \sim .02$ to $.03$	490, Deinzer, et al.	1965
28	$X = .75,\ Y = .22,\ Z = .03$	534, Nagaratnam, et al.	1961
28.2 E	$X = .75,\ Y = .22,\ Z = .03$	550, Schwarzschild, et al.	1958

30 E	X = .68, Y = .31, Z = .01	514, Henyey, et al.	1959
30 E	X = .70, Y = .27, Z = .03, X_{CNO} = Z/2	558, Stothers	1963
30 E	X = .70, Y = .27, Z = .03 X_{CNO} = Z/2	559, Stothers	1964
30 E	X = .70, Y = .27, Z = .03, X_{CNO} = Z/2	560, Stothers	1966
30 E	X = .70, Z = .05, X_{CNO} = Z/7	529, Kotok	1966
30.1 E	X = .75, Y = .23, Z = .02	519, Hoyle	1960
30.2	X = .75, Y = .24, Z = .01	506, Haselgrove, et al.	1959
32.0 E	see p 98	480, Blackler	1958
32.1	Y = 1.0	489, Deinzer, et al.	1964
32.1	Y = .999, Z = .001	497, Divine	1965
37.0	X = .75, Y = .24, Z = .01	506, Haselgrove, et al.	1959
40 E	X = 1.0	567, Van der Borght	1964
40.0	Y = .999, Z = .001	497, Divine	1965
43.0	Y = .98, Z = .02	485, Cimino, et al.	1963
45	X = .7, Y = .27, Z = .03, X_{CNO} = Z/2	561, Stothers	1966
46.8 E	X = .9, Y = .08, Z = .02	547, Sakashita, et al.	1959
46.8 E	X = .9, Y = .08, Z = .02	548, Sakashita, et al.	1961
46.8	X = .90, Y = .08, Z = .02 X_{CNO} = Z/3	564, Tanaka	1966
50	X = 1.0	498, Ezer	1961
55.5	X = .75, Y = .24, Z = .01	506, Haselgrove, et al.	1959
60 E	X = 1.0	567, Van der Borght	1964
60.0	Y = .999, Z = .001	497, Divine	1965
60	X = .7, Y = .27, Z = .03, X_{CNO} = Z/2	561, Stothers	1966

62.7 E	$X = .75$, $Y = .22$, $Z = .03$	550, Schwarzschild, et al.	1958
64 E	see p 98	480, Blackler	1958
78.21 E	$Y = 1.0$	489, Deinzer, et al.	1964
80 E	$X = 1.0$	567, Van der Borght	1964
83.3	$X = .75$, $Y = .24$, $Z = .01$	506, Haselgrove, et al.	1959
85	$Y = .98$, $Z = .02$	485, Cimino, et al.	1963
100	$X = 1.0$	498, Ezer	1961
100	$X = .7$, $Y = .27$, $Z = .03$ $X_{CNO} = Z/2$	561, Stothers	1966
120 E	$X = 1.0$	567, Van der Borght	1964
121.1 E	$X = .75$, $Y = .22$, $Z = .03$	550, Schwarzschild, et al.	1958
125	$X = .75$, $Y = .24$, $Z = .01$	506, Haselgrove, et al.	1959
128 E	see p 98	480, Blackler	1958
174 E	$X = 1.0$	484, Boury	1963
200	$X = 1.0$	498, Ezer	1961
200	$X = .7$, $Y = .27$, $Z = .03$ $X_{CNO} = Z/2$	561, Stothers	1966
214	$Y = .98$, $Z = .02$	485, Cimino, et al.	1963
218.3 E	$X = .75$, $Y = .22$, $Z = .03$	550, Schwarzschild, et al.	1958
300	$X = 1.0$	498, Ezer	1961
306 E	$X = 1.0$	484, Boury	1963
387.7 E	$Y = 1.0$	489, Deinzer, et al.	1964
400	$X = .7$, $Y = .27$, $Z = .03$ $X_{CNO} = Z/2$	561, Stothers	1966
500	$X = 1.0$	498, Ezer	1961
611 E	$X = 1.0$	484, Boury	1963
750	$X = 1.0$	498, Ezer	1961

1000	X = 1.0	498, Ezer	1961
1000	X = .7, Y = .27, Z = .03, X_{CNO} = Z/2	561, Stothers	1966
1515 E	X = 1.0	484, Boury	1963
2000	X = 1.0	498, Ezer	1961
4705 E	Y = 1.0	489, Deinzer, et al.	1964
6645 E	X = 1.0	484, Boury	1963

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