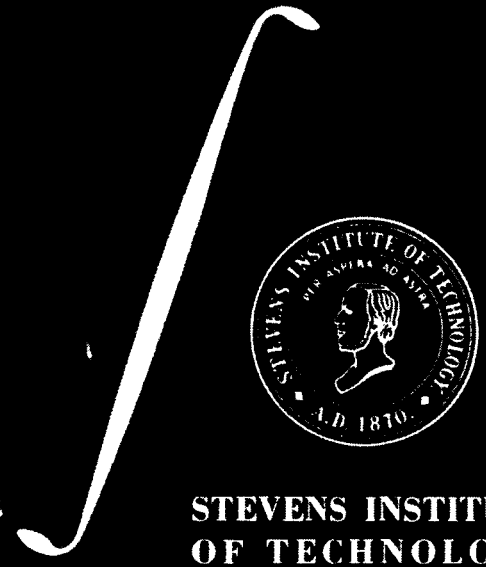

STEVENS INSTITUTE
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CASTLE POINT STATION
HOBOKEN, NEW JERSEY

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by

Jack Fajans

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The technical personnel engaged in grant activities have been Dr. J. Fajans at the rate of one day per week since 15 September 61, Dr. F. Pollock full time from 15 June 61 to 15 Sept 61, and Dr. J. K. Percus at the rate of one day per week since 15 April 61.

Construction of the flow chamber and manometer system for the study of superfluid at subcrititcal velocities has begun.

Dr. Pollock has begun construction of apparatus for the study of superfluid at high pressure under the action of strong electric fields. He has made a proposal (technical abstract appended) to NASA and the Air Force Office of Scientific Research for additional support of this work.

Dr. Percus' work has proceeded along theoretical lines.

A series of investigations is underway with the intention of expressing the dynamics of Helium II with and without external field, in terms of parameters associated with pure phonon excitations of the homogeneous fluid. In each case, the true state (or density metrix) is depicted as a macroscopic modification of an appropriate state of the latter type. In a study nearly concluded, the transformation was strictly multiplicative. A companion investigation now being completed is based upon a simultaneous one-body unitary transformation of all fluid particles. From the point of view of application, the subcase of distortion of one-body configuration space appears most promising. An attempt is being made to estimate residual corrections.

Fajans and Percus will continue work at the rates given above.

ABSTRACT

Investigations are proposed involving an experimental and theoretical program designed to investigate various properties of the structure of helium both in its atomic form and in the aggregates of the liquid and solid states. The key to the possibilities of performing the experiments lies in the relatively weak electric fields existing in liquid and solid helium and the possibility of producing external fields almost comparable with the internal fields. It is proposed to examine a) the melting pressure curve for helium as a function of electric field b) the dielectric constant of helium as a function of pressure and electric field c) in the future, the effect of electric fields on the λ transition.

From the results of these experiments one would expect to be able to gather at least corroborative evidence on a) the crystal structure of solid helium and evidence on b) the effect of the Van der Waal interaction of the electric polarizability of helium, c) the possibility of producing helium molecules d) the effective volume available to helium atoms in the liquid and possibly e) the effect of particle interactions on the Bose-Einstein condensation.