ED11. A Derivation of the Born Interpretation from the Other Postulates of Quantum Mechanics. NEILL GRAHAM, *Concord College*—It is shown that the Born interpretation is not an independent assumption of quantum mechanics but can be derived from the other postulates. This is done by considering an ensemble of identical systems in the same quantum state and describing this ensemble by a state vector. An operator corresponding to the observable "the relative frequency of systems in the ensemble for which the observable A has the value A′" is then defined. As the number of systems in the ensemble becomes large the state vector of the ensemble becomes an approximate eigenstate of the relative frequency operator. It is shown that the eigenvalue of the relative frequency operator corresponding to this approximate eigenstate is simply the probability of observing A′ predicted by the Born interpretation.

Session EE

FRIDAY MORNING AT 8:30

Room 349
(ARTHUR BROYLES, presiding)

Fluids

Invited Papers

EE1. Approach to Equilibrium in Statistical Mechanics. HARRY S. ROBERTSON, *University of Miami* (30 min.)

EE2. Some Remarks on the Dynamical Theory of Gases. L. H. THOMAS, *North Carolina State University at Raleigh* (40 min.)

ABSTRACT

WITHDRAWN

EE4. Path Integral Calculation of the Quantum Statistical Density Matrix.* R. G. STORER, *University of Florida,* **and A. D. KLEMM,** *The Flinders University of S. Aust*—A development of the path integral formulation of quantum mechanics is outlined which enables one to calculate the density matrix for any two particles system. The density matrix is calculated for a wide range of temperatures by an iterative procedure using direct numerical quadratures. This technique has been used to calculate the two particle contribution to the radial distribution function for helium and for systems interacting via Coulomb forces.

* Work supported in part by the Australian Research Grants Committee.

EE5. Obtaining Properties of Multi-Component Fluids from Effective Potentials.* M. A. POKRANT, T. DUNN, and A. A. BROYLES, *University of Florida*—A method for calculating the radial distribution functions for high density fluids of nuclei and electrons is presented. A product of pair functions is used to approximate the Slater Sum. Each of these pair functions depends only on the spatial separation of the two particles and is in the form of a classical Boltzmann factor with an effective potential replacing the classical coulomb potential. Various powerful techniques of classical statistical mechanics are then available to obtain the radial distribution functions. The classical divergence at zero particle separation is, of course, not present in the effective potentials. The quantum effects are separated into symmetry effects, diffraction effects, and coupling between the two. The coupling is treated approximately. At infinite temperature the method is exact; it also appears to be quite good even when atoms are formed.

* Work supported in part by the National Science Foundation.

EE6. Determination of Effective Potentials (via Slater Sums) for Several Proton-Electron Systems in Their Ground State.* A. A. BARKER, *University of Florida*—The evaluation of accurate effective potentials between components of a system enables the computation of radial distribution functions, and hence the equation of state of the system. The usual definition of the effective potential via the Slater Sum is adopted. For a many body system a direct evaluation of the Slater Sum is unfeasible, although this has been done for several two-particle systems. Now for stable systems (composed of a small number of particles) in their ground states, the Slater Sum is dominated by the ground state term. This fact is utilized, with known ground state wave functions, to obtain effective potentials from H, H^-, H_2^+, H_3^+, and H_2. The results show that the effective potentials (especially at short range) are quite sensitive to the numbers and types of particles in the near vicinity.

* Work supported in part by the National Science Foundation.

EE7. New Methods of Measuring Both Density and Viscosity with a Small Volume of Fluid.* J. W. BEAMS and M. G. HODGINS, *University of Virginia*—A gold plated ferromagnetic Cylinder .08 cm diam, and .32 cm long is magnetically suspended[1] with its axis vertical at a definite height inside a co-axial glass tube 0.3 cm i.d. which is filled with the fluid (0.1 cm^3 protein solution) to be investigated. The Current in the air core supporting coils is a function of the density of the fluid which completely surrounds the supported cylinder. By calibration with fluids of known density, the unknown density of the specimen is determined. The supported cylinder is next slowly spun around its vertical axis by a rotating magnetic field. The power input to the drive is a function of the rotor speed and viscosity of the fluid surrounding the rotor, so that after calibration with fluids of known viscosity the unknown viscosity is determined. The densities are routinely determined to one part in 10^5 and viscosities to 5 parts in 10^4. The method is capable of greater accuracy.

* Supported by U.S.P.H. Grant GM-11630-10. I. J. W. Beams and A. M. Clark. Rev. Sci. Instr. *33*, 750 (1962).

EE8. Hard Core Fermi Systems via Point Transforms.* NORMAN M. WITRIOL, *Redstone Arsenal*—The hard core many body Fermi system is treated using the method of pairwise point transforms.[1] The ground state energy and Landau parameters are calculated to second order in the hard core radius. The dilute gas limit of these results is taken and shown to agree with the previous calculations of these parameters for the dilute system.[2,3] The application of this method to nondilute physical systems is discussed.

* Performed in part at Brandeis University under USAFOSR support.
[1] F. M. Eger and E. P. Gross, J. Math. Phys. *7*, 578 (1966).
[2] K. Huang and C. N. Yang, Phys. Rev. *105*, 767 (1957).
[3] A. A. Abrikosov and I. M. Khalatnikov, Sov. Phys.—JETP *6*, 888 (1958).

Session FA

FRIDAY AFTERNOON AT 1:30

Auditorium
(S. M. SHAFROTH, presiding)

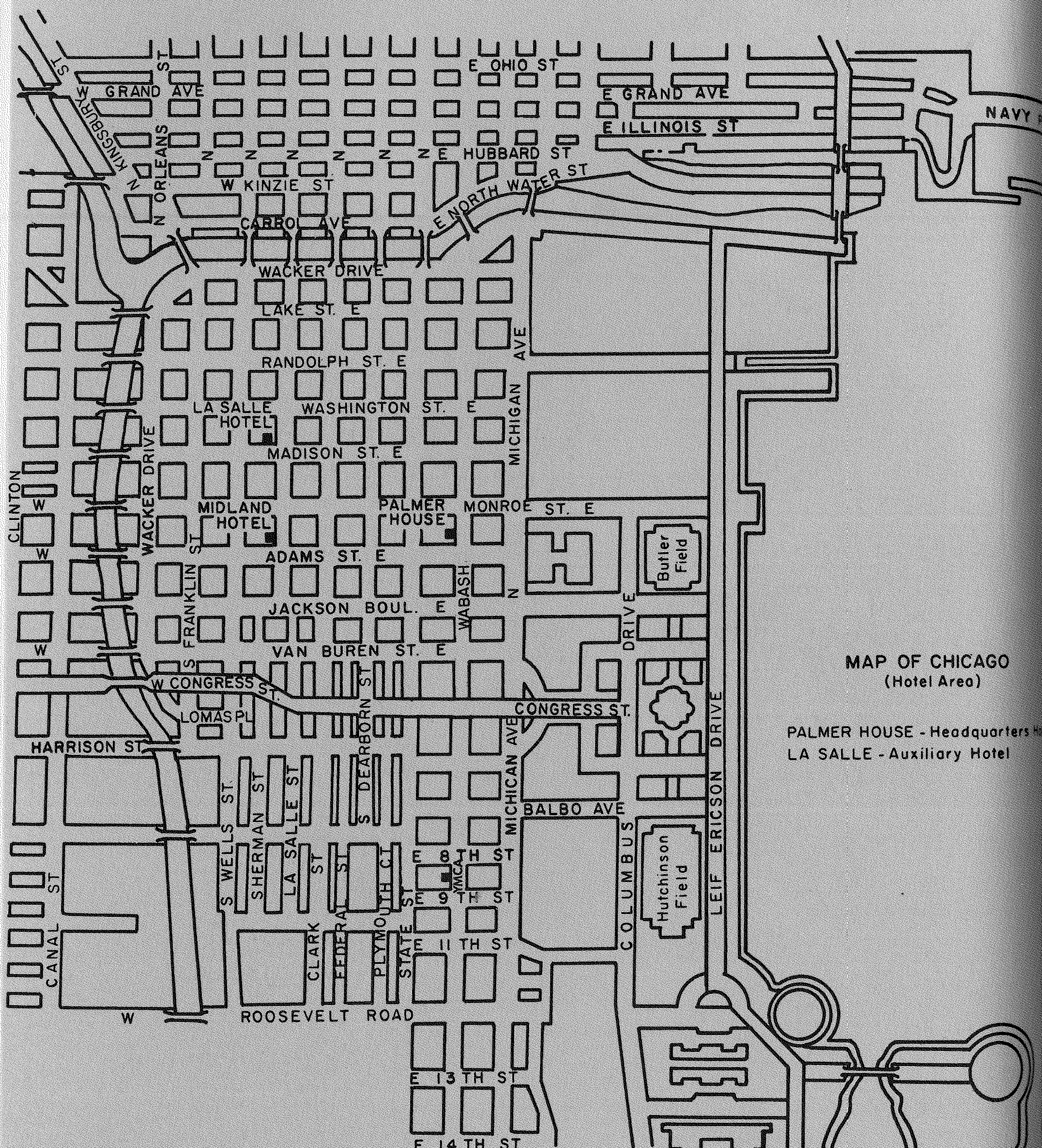
Nuclear-Analog Resonances, Shell Model, Optical Model, Radioactivity and Scattering $20 \leq A \leq 91$

Invited Papers

FA1. Shell Model Studies in Intermediate Mass Nuclei with (d, p) and (α, 3He) Reaction. CARROL R. BINGHAM, *University of Tennessee* (30 min.)

FA2. Isobaric Analog Resonances in Medium Weight Nuclei. G. E. MITCHELL, *North Carolina State University at Raleigh* (30 min.)

FA3. Study of States in ^{19}Ne by the Reaction ^{20}Ne(^{3}He,^{4}He)^{19}Ne.* D. S. HAYNES, K. W. KEMPER, and N. R. FLETCHER, *The Florida State University*—The states of ^{19}Ne have been studied by the reaction ^{20}Ne(^{3}He,^{4}He)^{19}Ne up to an excitation energy of 9.7 MeV, using an 18 MeV beam of ^{3}He particles from the Florida State University tandem accelerator. A closed volume gas target with a 0.5 μ Ni beam entrance window, operated at a pressure of approximately 10 cm. of Hg, was used with a silicon



MAP OF CHICAGO
(Hotel Area)

PALMER HOUSE - Headquarters Hotel
LA SALLE - Auxiliary Hotel

bulletin

OF THE AMERICAN PHYSICAL SOCIETY

FEBRUARY 1970

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