superb illustrations. I heartily recommend that it find a position on your bookshelf.

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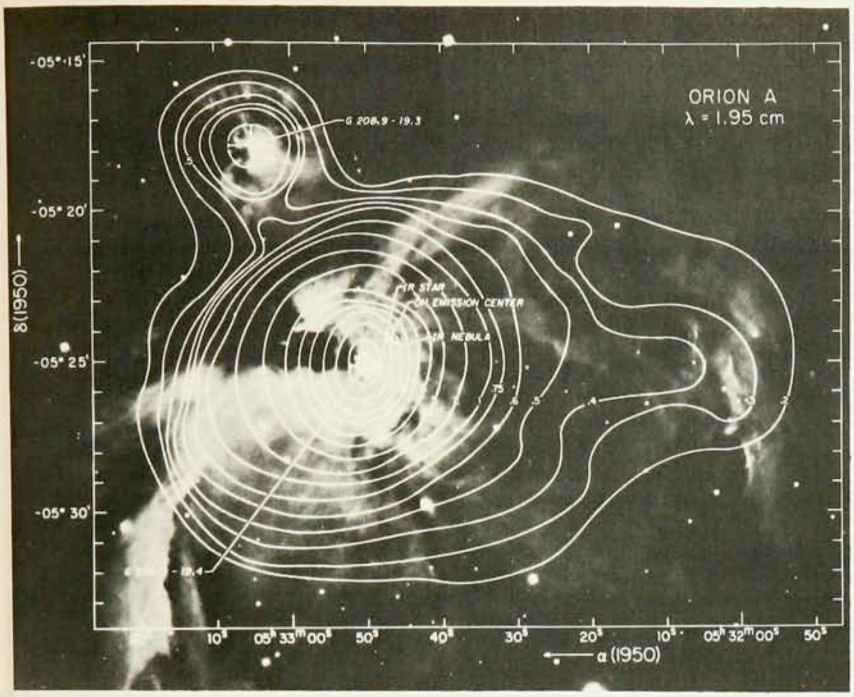
Stellar Formation

V. C. Reddish
287 pp. Pergamon, Elmsford, N.Y.
$30.00 clothbound, $15.00 paperbound.

It is clear that luminous main sequence stars found in the spiral galaxies must have formed recently from the relatively dense interstellar clouds of gas and dust concentrated in the arms. That we can say this is indicative of the progress that has been made in understanding the characteristics of young stars and the distribution and physical conditions inside dense interstellar clouds. However, star formation is an exceedingly complex topic, and many interesting and fundamental questions remain unsolved. V. C. Reddish's *Stellar Formation* is a concise and well-written discussion of observational and theoretical studies in this important field.

The observed frequency distribution of stars as a function of mass can be used to determine the relative number of stars formed per unit range of mass. Throughout much of our Galaxy the stellar birth rate function, which is called the Salpeter function, has the simple form $\phi = Km^{-x}$ ($x \simeq 2.35$) for stellar masses $\gtrsim 0.25\ M_\odot$. Any satisfactory theory of star formation must explain the observed mass dependence of the Salpeter function as well as the rate at which stars form at different locations within the Galaxy. If stars form by the collapse of observed interstellar clouds then the frequency distribution of clouds and stars should be related. On the other hand, if stars form as a result of the fragmentation of massive interstellar clouds (most likely molecular clouds) the frequency of massive clouds and aggregates of stars should be related. The number of compact HII regions is a measure of the rate of formation of luminous main sequence stars. It is likely that the rate of star formation is associated with the distribution of H_2. Observations of the 2.6 mm radiation from carbon monoxide provide the best means of inferring the distribution of H_2 throughout the Galaxy. *Stellar Formation* discusses attempts the explain the rate at which stars of different mass are formed as well as the observations that are the basis of these efforts.

The ordering of clouds and young



Radio map of a portion of the Orion Nebula that is a probable site of star formation. This type of region is described in *Stellar Formation* by V. C. Reddish. (photograph: NRAO)

stars into the spiral arms is the most obvious structural feature of spiral galaxies. Reddish summarizes the density wave theory for the origin of spiral arms. According to this theory the spiral-arm structure does not wholly share the differential rotation of the mass of clouds and stars. It is likely that shock waves produced by the movement of density waves through galactic clouds are effective in compressing them sufficiently that some become unstable against gravitational contraction or collapse.

The book contains a discussion of how the evolution of galaxies is influenced by the birth and death of stars. The integrated properties of spiral, elliptical and irregular galaxies indicate that star formation proceeds at different rates in different types of galaxies. In the case of elliptical galaxies, most star formation appears to have taken place during the initial collapse of the protogalaxy. The formation of numerous low-mass stars has apparently been preceded by the formation and explosion by supernova outburst of a large number of massive stars.

Interstellar grains and molecules must play very important roles in the process of star formation. Reddish has made numerous research contributions to this field and has been particularly interested in understanding the effects of interstellar grains. The book describes much of this work. Its principal shortcoming is its lack of a systematic discussion of interstellar molecules.

The reader who has some background in astronomy will find the book an interesting and very useful introduction to research in the field of star formation.

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Fundamentals of Quantum Mechanics

V. A. Fock
368 pp. Mir, Moscow, 1978 (Imported Publications, Chicago, Illinois) (first Russian ed., 1932). $7.50

This book, translated by Eugene Yankovsky from the greatly augmented 1976 Russian edition, should be valuable to those who like or need lengthy mathematical derivations of properties of spherical harmonics and of radial functions used in one-electron wave mechanics. The book covers several of the topics one expects in an introduction to quantum mechanics and a few valuable additional topics, but the omission of other important fundamentals of quantum mechanics makes the title of the book somewhat pretentious.

Considering Vladimir Fock's own outstanding contribution to the theory of second quantization,[1] it is somewhat disappointing that this book merely mentions this subject without elaboration on the second to the last page. Also, after a discussion of Dirac's relativistic wave mechanics in the last part of the book, positron theory is merely mentioned in its original primitive form using holes in a sea of negative-energy electrons, ignoring the progress made since then.[2] Fock's introduction of the Dirac equation itself is as axiomatic as Dirac's and lacks the elegance and pursuasiveness of the method based on considerations of covariance found in H. A. Kramers's book on quantum theory.[3] The author's discussion of the many-electron problem does state a few of the important results of multiplet theory, but as the book does not justify these statements by either derivation or application, a student reader without prior knowledge of the topic would remain confused. For instance, Fock uses the spin permutation operators P_{ij} in a formula for the square of the total spin without explaining or even mentioning that $P_{ij} = (1/2)(\sigma_i \cdot \sigma_j + 1)$. The vector model is once mentioned by name, but never explained. Again, Kramers's book gives a far better introduction for all of this.

Fock's discussion of perturbation theory for stationary states goes beyond what is found in most English texts by discussing the zeroth-order wave functions to be used for first-order calculation of the perturbed energy levels in the case of two adjacent unperturbed energy levels.[4] He also discusses the Stark effect and the wave functions for valence electrons and for cores or closed shells, with a brief mention of the Hartree–Fock equations. However, the book does not discuss time-dependent perturbation theory at all, so that he bases the selection rules for spectral lines completely upon semi-classical radiation theory, while the discussion of scattering is very brief and incomplete.

Fock tries to discuss the meaning of the wave function. Here it is most disturbing that he does not discuss at all the density matrix formalism introduced by John von Neumann.[5] As quantum-mechanical states describe probability distributions, it is usually said that they describe ensembles. Fock notes that for each different quantity Q measured on particles or systems in a given quantum state ψ, there is a separate ensemble (say $E_Q(\psi)$). While ψ describes all measurements that are "potentially possible," each of these $E_Q(\psi)$ describes "the accomplished" of a particular choice of Q. Most people would conclude that Fock's ensembles $E_Q(\psi)$ are simply subensembles of what they would call the ensemble E (ψ) described by ψ. Fock's claim that this ensemble E (ψ) would not exist then merely means that his definition of an ensemble somehow is narrower than the definition of an ensemble used by those who define E (ψ) as the union of all the author's $E_Q(\psi)$ with common ψ, so that this seeming difference in