Shoenberg's book briefly reviews this early work and nicely details the considerable progress that has been made during the last 50 years.

The book contains an excellent chapter on theory that discusses the connections between the oscillatory behavior of the magnetization, found in virtually every metallic element, and the Landau-level quantization that results when electrons are subjected to an applied magnetic field. In addition to the standard theoretical results familiar to early workers in this field, more recent advances, including the many-body interactions required for a complete description of the electronic states, are covered. The detailed chapters that follow cover every major aspect of the subject. A separate chapter is devoted to a general discussion of specific magnetic oscillatory effects that are found to be ubiquitous in measurements of physical properties at low temperatures and high magnetic field strengths. The chapter considers such effects as magnetoresistance, magnetostriction, and ultrasonic attenuation, which are often neglected in less comprehensive discussions of the subject. The book includes discussions not only of the original work that dates back into the 1930's but also of some of the most recent and significant studies of oscillatory properties in different systems. For example, there are brief discussions of the quantized Hall effect observed in a two-dimensional electron gas, the most recent advances in quantum interference effects induced by magnetic breakdown, and results concerning Fermi surface geometry recently obtained for metallic compounds. Furthermore, the author has indicated topics that are not well understood and are deserving of further work.

The book is well written, and the author succeeds in conveying his own understanding and appreciation of the subject. The book is liberally illustrated with experimental data and contains many explanatory diagrams that are exceptionally well described in lengthy figure captions. There are many tables of useful data that have been collected from many different sources. An excellent collection of appendixes enlarges upon the more mathematical aspects of the physical arguments developed in the text. There is a bibliography with well over 500 references.

The strength of the book lies in its careful, comprehensive survey of the entire field of magnetic oscillations in metals. The book will undoubtedly become a much-valued reference work for investigators in the field. In addition, the care and attention Shoenberg expends in discussing the relevant physical principles will readily permit nonspecialists to assess the significance of most published results derived from studies of magnetic oscillatory behavior.

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Interstellar Grains

Proceedings of the Workshop on Laboratory and Observational Infrared Spectra of Interstellar Dust. (Hilo, Hawaii, July 1983.) R. D. WOLSTENCROFT and J. MAYO GREENBERG, Eds. Royal Observatory, Edinburgh, 1984. viii, 174 pp., illus. Paper. Occasional Report of the Royal Observatory, no. 12.

This provocative workshop volume attempts to integrate laboratory and observational infrared spectroscopy of interstellar dust. It has quickly become a standard reference for my graduate students and me.

The 25 papers in the book concentrate on current observational and theoretical studies of grain formation and destruction, as well as on efforts to divine the nature of interstellar grains through infrared spectroscopy of specific adsorption bands and emission features and through studies of the infrared scattering and polarizing properties of interstellar grains. These observational efforts are supplemented by descriptions of relevant laboratory experiments.

A number of authors comment on the need for reliable infrared spectroscopic observations obtained at a good site with an accurately pointing telescope and a small beam size. Most of the data obtained to date on the unidentified 3.28- and 3.4-μm dust emission feature have been obtained with low spectral resolution (usually a circular variable filter wheel resolution of ~100) at a variety of spatial positions with relatively large beams. Sellgren reports that the 3.28-μm feature is found in several optical reflection nebulas and in concert with dust emission (not scattering) at a color temperature of ~1000 K. Brand and collaborators report having shown that the emission was constant across the NGC 2024 ionization edge (low-excitation HII region) using an 8-inch beam to make the observations. Similar results for other regions had been reported. The results of both Sellgren and Brand *et al.* emphasize that hard ultraviolet photons are not required to excite the feature, as had been previously hypothesized. Isaacman came to a similar conclusion in his studies of the high-excitation source NGC 7027. Gatley points out that measurements of line strength as a function of spatial position are the key to understanding the range of physical conditions responsible for excitation of the 3.28-μm emission. These measurements will play a key role in the identification of the emission mechanism and ultimately of the grain constituents of the emission. High-resolution spectroscopy by Geballe of an HII region and a high-excitation planetary nebula demonstrate the importance of an accurate determination of the underlying continuum in studies of the shape and strength of the spectral feature. It now appears that conditions for production of the feature occur in a wide variety of situations; the original contention that the feature was produced by a volatile substance located at ionization fronts has been proved incorrect. Gatley emphasizes that the feature may even be strongest where the underlying continuum is strongest but where the contrast is small. All of these papers point to the need for observations of high spatial and spectral resolution. With the advent of infrared array cameras, and with carefully chosen objects of study as well as adequate spectral coverage, it may soon be possible to provide a plausible model of feature emission. Several papers and the discussion in this volume have been pivotal in directing research efforts since the workshop.

Several papers discuss infrared reflection nebulas. Pendleton and collaborators present data on the OMC2 cluster. Dinerstein focuses on the polarimetry from 2.2 to 4.9 μm of the BN region in OMC1. She first summarizes recent observations by a number of authors who attribute the polarization of BN and IRc2 (the principal luminosity sources in the region) at least partially to dichroic absorption. However, her polarimetry of two other positions in the nebulosity, IRc3 and IRc4, suggests that they are scattering centers externally illuminated by BN or IRc2. The wavelength dependence of the polarization that she presents is suggestive; clearly a map of the polarization wavelength dependence, coupled with photometric images at several infrared wavelengths, will provide the potential for decoupling the thermal and scattering components of the emission, as well as provide insights into the scattering optical depth and the infrared grain properties. Another important series of observations that should ultimately lead to an understanding of the interstellar grain properties are the spectrophotometric and polarimetric observa-

tions in the infrared of optical reflection nebulas by Sellgren. Her suggestion that 10-Å grains may be an important constituent of interstellar dust (as a consequence of these observations) has driven theoretical and observational research in this area in an entirely new direction since the workshop.

A thoughtful paper by Greenberg on the evolution of interstellar grains provoked substantial discussion of grain mantles, and the discussion provides background for papers on ice and other mantle constituents. Both Tielens and Greenberg summarize laboratory and theoretical efforts on this subject. The models are in reasonable agreement with astronomical observations, with the exception of observations in the 6.8-μm band. Tielens appeals for astronomical observations having greater spectral resolution. It had been thought that the 3.1-μm ice feature, which is seen in absorption to protostellar objects and various sources in the galactic center, is produced only in regions deep within molecular clouds, perhaps within circumstellar clouds, rather than in the cloud medium itself. Whittet and collaborators have definitively shown that the ice feature is carried in the molecular cloud medium. They present spectroscopic observations of both field stars and embedded stars in the Taurus cloud; the ice-absorption feature was seen in the spectra of both. For $A_V>5$, the 3.1-μm optical depth is proportional to A_V, so that the threshhold for shielding of ultraviolet radiation is very low. Greenberg and van de Bult provide theoretical grounds for the interpretation of the ice-band observations. The Whittet *et al.* result is interesting in that Greenberg and van de Bult find that interstellar ice mantles form at very low temperatures (~10 K).

Supernova shocks destroy interstellar grains. Seab and Shull discuss observable effects of this process on the interstellar extinction curve for high shock velocities. Given a slow enough relative velocity behind the shock, accretion may take place. In a most interesting paper exploring supernovas as a source of interstellar dust, Dinerstein reviews infrared observations of two type-II supernovas that developed warm (800 K) infrared components in the first year after outburst. The components have been thought to result from condensation of dust or heating of preexisting circumstellar dust. A search for 10-μm dust emission from fast-moving knots yielded controversial results. A blue-shifted line of SIV (10.5 μm) plus other ionic constituents may account for the 10-μm flux density that Dinerstein and her collaborators observed. Further infrared spectral observations of supernovas are required to investigate dust condensation.

The greatest asset of the book is the frank discussion of past misconceptions, which were based on incomplete, low-resolution data. Future work on the properties of interstellar dust can only benefit from the authors' explicit statements of observational requirements that must be met in order to answer specific questions.

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Human Paleoecology

Hominid Evolution and Community Ecology. Prehistoric Human Adaptation in Biological Perspective. ROBERT FOLEY, Ed. Academic Press, Orlando, Fla., 1984. xiv, 299 pp., illus. $37.50. Studies in Archaeology. Based on symposium, Reading, England, Dec. 1981.

This collection of 11 papers is largely the result of a symposium organized by the editor for a meeting of the Theoretical Archaeology Group. Foley personally and in assembling these papers has made a conscientious attempt to further the rapprochement of paleoanthropology and paleoecology. This is a difficult and often elusive goal, so it is not surprising that this book is uneven and only partly successful. Foley's introductory chapter, "Putting people into perspective," provides an excellent brief introduction to community evolution and ecology for prehistorians and raises hopes for a generally stimulating, innovative volume. Unfortunately, much of what follows is—from the perspective Foley establishes—either inconclusive or irrelevant.

The two chapters immediately following Foley's, N. Roberts's "Pleistocene environments in time and space" and C. Stringer's "Human evolution and biological adaptation in the Pleistocene," would fit very well into a much-needed advanced textbook on Quaternary studies. They provide fine, factual reviews of Plio-Pleistocene chronostratigraphy, environmental change, and the process and outcomes of hominid evolution. Both chapters should be assimilated by anyone attempting to deal with the evolution of our lineage. It is, for example, a shame that the implications of the deep-sea oxygen isotope record pointed out by Roberts have still not been universally perceived and taken into account. Stringer's chapter is particularly valuable because it not only summarizes the interpretations of many workers in the field of hominid evolution but presents results of some of his latest analyses of body and brain size. Regrettably Stringer avoids attempting to integrate cultural with biological adaptations in his scenario.

Foley's second chapter, "Early man and the Red Queen," is interesting in its definition of key ecological parameters relevant to early hominid evolution but disappointing in terms of actual conclusions. The material presented on adaptive problems whets the reader's appetite for a cohesive model addressing the big question: "why us?" But, as usual, the requisite data are lacking, and one is left with an essay that simply puts the problem into context—albeit elegantly.

There follow two chapters concerned with the currently hot topic of early hominid hunting and scavenging: A. Hill's "Hyaenas and hominids" and R. Potts's "Hominid hunters?" In the wake of work by C. K. Brain and L. R. Binford, long-held theories of Australopithecine and *Homo erectus* big game hunting and G. L. Isaac's more recent food-sharing hypothesis have provided major topics for sophisticated ethological, taphonomic, paleontological, and microwear research. Hill's chapter, though lacking clarity and focus, provides further valuable information on hyena bone-transport behavior. The section on philosophy of science seems a bit contrived and the exposé on Makapansgat provides a sense of *déjà vu*. Potts's is a far more substantial, cohesive, and, ultimately, thoughtful chapter—one of the best of the book, though also inconclusive because of the nature of the data. Potts carefully lays out the basis for the debate and provides intriguing information on the possible significance of consumption of meat (*sensu lato*) among our earliest ancestors. The ecological data on other predators and scavengers (including vultures) are relevant and suggestive. Potts provides data—many of them his—on the context and composition, breakage, cut marks, and associations with artifacts of the Olduvai Gorge bone assemblage. He concludes that the early hominids did sometimes eat meat, but finds it highly unlikely that they accumulated bones at "home bases" (since these would attract other carnivores). His alternative hypothesis of bone and stone caches (located where hominids did not live) is, however, rather strained. J. A. J. Gowlett's chapter, "The mental abilities of early man," provides little new information on this vague, elusive topic, relying as it does