

ing form factor analysis with Feynman diagrams. It is perhaps a related feature that Scheck discusses radiative corrections, in most places, only superficially. The one notable exception to both of these criticisms is the very clear discussion of the process $\pi^- \rightarrow e^- \nu \gamma$.

Scheck's textbook should be useful as a practical guide for students and researchers. It will probably be of particular value to those interested in the interface between nuclear and particle physics. Although Scheck does not discuss the subtleties of nuclear structure, he is well aware of them, and he often points out where particular nuclear corrections can be plugged into his analyses. To those seeking a broader introduction to modern theoretical particle physics, I would recommend the excellent textbook *Elementary Particle Physics* by Otto Nachtmann (Springer-Verlag, 1990).

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Dusty and Self-Gravitational Plasmas in Space

Paval Bliokh, Victor Sinitsin
and Victoria Yaroshenko
Kluwer, Norwell, Mass., 1995.
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While dust is an almost ubiquitous component of the cosmic plasma environment, the study of cosmic dusty plasmas was pursued until recently by only a handful of scientists. The observation of peculiar features in the Saturnian ring system (such as the radial "spokes") by the Voyager spacecrafts in the early 1980s could not be explained by purely gravitational means, and thus gave a major boost to this field. Since then the study of dusty plasmas has seen rapid progress.

Early studies of the motion of charged dust in planetary magnetospheres under the combined influence of planetary gravity and the Lorentz force ("gravitoelectrodynamics") led to a series of successes including, more recently, the only plausible explanation of the high-speed collimated streams of fine dust found, by the Ulysses and Galileo spacecrafts, to emanate from Jupiter. These dynamical studies have in more recent times been complemented by the study of collective processes in dusty plasmas, leading to the discovery of a whole slew of new wave modes and associated instabilities, with important consequences to transport and heating in various dusty cos-

mic environments.

While a number of international conferences and workshops have been devoted to the physics of dusty plasmas and resulted in published proceedings in recent years, *Dusty and Self-Gravitational Plasmas In Space* by Pavel Bliokh, Victor Sinitsin and Victoria Yaroshenko is the first monograph to treat the subject. Its first chapter deals with the central topic, namely the electrostatic charging of both isolated grains and grain ensembles in a plasma, and discusses a number of physical consequences of charging, such as grain fragmentation and coagulation. The following chapter deals with the gravitoelectrodynamics of charged dust in planetary magnetospheres. Subtle processes, such as the so-called gyrophase drift associated with the changing charge on the grain during its epicyclical motion, are clearly explained with the aid of useful figures. The next two chapters deal with collective processes in dusty plasmas (waves and instabilities).

The main difference between the present formulation and those of other authors is the inclusion of self-gravity, which requires the supplementary Poisson equation relating the gravitational potential to the mass distribution. While this leads to more general dispersion relations, with more cumbersome algebra, the self-gravitational term plays no important role in virtually any problem of interest, at least within planetary magnetospheres. A possible exception is considered in the final chapter in connection with the narrow rings of Uranus, where a drifting, growing Jeans instability is associated with small-scale longitudinal inhomogeneities. In this case, however, the electrical forces play no significant

role. This last chapter concludes with a useful review of the various theories of spoke formation, all of which invoke electromagnetic effects.

All in all, I consider this text a well-organized presentation of a wide variety of topics in this interesting field. It will be useful both to specialists and beginning graduate students. Perhaps the only significant omission is the fascinating recent laboratory demonstration of crystallization of dusty plasmas. While the existence of such crystals in space is debatable, it is interesting to note that the inspiration for at least one experiment was provided by the suggestion that such structures may form in the "cold" dusty plasma environment of deep space, such as the Uranian rings.

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Semiconductor Characterization: Present Status and Future Needs

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David G. Seiler
and Alain C. Diebold
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Semiconductor characterization has proved to be fundamental in the development of semiconductor technology and in the improvement of semiconductor manufacturing. As a tool, it has made possible the determination of the structure, composition, properties and performance of materials and the interrelationships among those characteristics.

