

Book Reviews

The Evolution of Star Clusters

Dynamics of Star Clusters. JEREMY GOODMAN and PIET HUT, Eds. Reidel, Boston, 1985 (distributor, Kluwer, Hingham, MA). xxii, 622 pp., illus. \$69; paper, \$29. International Astronomical Union Symposium no. 113. From a symposium, Princeton, NJ, May 1984.

Soon after he had worked out his theory of gravity Newton presented a general solution for the orbit of two point masses under the influence of their mutual gravitational attraction. The three-body problem proved much harder to solve, and despite intensive study over three centuries, it remains a subject of active research. Indeed, one particular aspect of the three-body problem—the interaction of a binary system with stars drawn from an uncorrelated field population—is central to many of the papers in *Dynamics of Star Clusters*. However, the main topic of the symposium at which these papers were presented was the long-term evolution of systems of many point masses. The organizers were concerned to provide a forum for discussing and applying recent advances in theoretical understanding of this problem. As a result, both the meeting and the book focus primarily on globular star clusters rather than on their younger and sparser cousins in the Galactic disk, on theoretical work rather than on observational studies, and on the central cores of clusters rather than on their outer regions. Nevertheless, enough material on these other aspects of the field is included for the book to be an excellent and complete survey of our present understanding of the dynamics of star clusters.

Old many-body systems such as globular clusters are in dynamical, but not in thermal, equilibrium. Gravitational encounters between pairs of stars act like physical collisions in an atomic gas but are unable to establish thermal equilibrium because of the peculiar thermodynamic properties of gravitating systems. In a concentrated cluster, encounters cause energy to be transferred from the dense inner regions to the main body of the system. This makes the cluster core more strongly bound, thereby increasing its effective temperature and enhancing the conductive energy flux to the outer regions. In an idealized model this “gravothermal catastrophe” causes the central density of a cluster to reach infinite values in a finite time; in real clusters some physical effect must intervene to halt core collapse before this limit is reached. Recent work has confirmed some extraordinarily prescient studies carried out by Michel Hénon in the

early 1960's; the formation of binary stars is able to stop core collapse and initiate a long evolutionary phase during which the cluster is gradually converted into an unbound assemblage of single stars together with a few binary stars and hierarchical multiple star systems that contain all the binding energy of the initial cluster.

The reviews and research papers in *Dynamics of Star Clusters* give a complete and detailed account of the growth of our understanding of the long-term evolution of many-body systems. In addition they are enlivened by an as yet unresolved disagreement about the possible occurrence of large-amplitude relaxation oscillations during later evolutionary phases. Such oscillations could affect the typical appearance of a cluster that has already undergone core collapse. It is clear that the unambiguous identification of such systems should be a major goal for future observational studies of cluster dynamics but that more realistic theoretical models will be needed before this goal can be fully realized. This point becomes clear during a discussion of the future of the subject, included at the end of the book. The discussion also suggests that subjects only peripherally treated at the meeting, such as the mass distribution in clusters, the effect of environment on the structure of clusters, and the manner of cluster formation, will be major research topics in the near future.

The discussion is an example of the care that the editors have taken to make the book a complete and useful treatment of the subject. Most of the text is made up of long review papers followed by transcripts of the verbal discussions that followed them at the conference. Translations of two classic papers in the field, previously available only in Russian, are included as appendixes, as are large compilations of basic data on globular and open clusters. *Dynamics of Star Clusters* is clearly destined to be a primary reference in its field for many years.

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Correlates of Well-Being

Social Support and Health. SHELDON COHEN and S. LEONARD SYME, Eds. Academic Press, Orlando, FL, 1985. xviii, 390 pp. \$40.

The importance of social support for a sense of well-being was recognized nearly 100 years ago in Durkheim's classic study of suicide, according to which persons integrated into enduring groups or relation-

ships—family, religious community, or organization—appeared to be less likely to commit suicide than those lacking such integration. In the past decade, following on a great increase in research on life stress, there has been an explosion of research and writing on the topic of social support. Many studies suggest that persons who can call upon resources supplied by others, particularly emotional support, show lower rates of psychological or physiological impairment than those without such resources. The measures of social support used have, however, been diverse and research findings inconsistent and sometimes contradictory.

In commissioning the papers in this collection, the editors sought to provide a “systematic and critical assessment of this outpouring of work, a guide for doing further research on social support and health, and a source of information on the implications of existing work for clinical practice and public policy.” Although the first of the collection's four parts is explicitly devoted to issues of conceptualization and measurement, it seems fair to say that almost all the authors are concerned with such issues, whatever else their emphases.

Cohen and Syme define social support as “the resources provided by other persons.” Those resources may consist of information, material, or other instrumental contributions, a sense of belonging, or emotional support and intimacy. They may come from the larger social organization or from a single confidant. They may enhance health, irrespective of stress, or they may act to buffer stress. As Cohen and Syme note, it does not advance our understanding much to know which of these they do unless we have specific hypotheses about how social support relates to various mediators of health—behavioral, emotional, and physiological. Among the general issues to be addressed are: the kinds of causal models needed to guide research; the circumstance that changes in social relationships may themselves be stressors; and the possibility that at least some of the relationships between social supports and health may be spurious, deriving from preexisting attributes of the persons that influence both social supports and health outcomes.

The papers immediately following Cohen and Syme's consider the uses of network analysis, social structure and processes of social support, the qualities of supportive interpersonal relationships, available scales and measures (none wholly adequate), and analytic issues in causal inference. The complexity of the research problem is perhaps best manifest in Pearlin's essay, where it is noted not only that different types of stressful problems require different solutions but