

## 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

also that supports are lodged in ongoing social relationships that vary over time and entail sequential linkages.

Part 2 of the collection examines social support through the life cycle. There is much evidence that unexpected or off-schedule life events are more stressful than those that are normatively scheduled; Schultz and Rau suggest that members of social networks are less likely to have the appropriate abilities or knowledge to provide support in the case of unexpected events and losses. Boyce suggests that for children the most crucial aspect of support is permanence in close ties. In the middle years, work and family roles entail both stresses and supports. Kasl and Wells give a good overview of what is known; they recommend as basic strategies a sharper focus on specific work settings, longitudinal studies set up around important transitions, and the elaboration of the causal network to include other influences on health outcomes (prior health status, biological risk factors, health-related behaviors, and medical care data). Viewing social support and health of the elderly, Minkler concludes that, contrary to widespread opinion, social support does not seem to play a different or more important role in influencing the health of the elderly than it does with younger adults.

Part 3, on social support and disease etiology, contains systematic assessments of what we know about social support and mental health from community samples and about the relation of social supports to morbidity and mortality and an examination of how styles of coping with stress may be influenced by social supports and resource mobilization. Kessler and McLeod assess the effects of social support by first evaluating the design adequacy of the various studies and then confining attention to the studies deemed adequate. From those they conclude that membership in affiliative networks is modestly associated with mental health, independent of stress, and that stress-buffering effects most often derive from emotional support. But mental health or social competence may influence support, so the direction of causation is moot. Kessler and McLeod conclude that evidence for the health-promoting potential of supports will require targeted interventions in specific high-risk crisis situations.

Berkman focuses on both methodological and conceptual issues in assessing the evidence for effects on mortality and morbidity. She notes the importance of cultural features that may influence response to questions about networks and supports in population surveys, sometimes leading to drastically wrong inferences from the responses. More than most authors, she emphasizes the need

for examining pathways leading to effects on health—the consequences of seeking help and of receiving care, the biological effects of shared modes of living, and the biological sequelae of stressors themselves.

Part 4 focuses on social support interventions and health policy. Wortman and Conway note that health status may influence perceived support, support may enhance the following of medical regimes, or support may directly act upon a person's sense of well-being and self-mobilization. Negative interactions may also occur as a consequence of misconceptions of the illness by significant others, overprotectiveness, the patient's rejection of dependency, or stigmatization. Potential negative influences are seldom assessed adequately in studies focused on social support. Gottlieb describes in some detail a number of interventions that seek to mobilize social networks or primary group supports to get alcoholics into treatment, to minimize intrusive critical interaction in families of schizophrenics, to aid children whose parents are divorcing, or to facilitate coping with other stresses and mental health problems. Here emphasis is more on approaches than on effectiveness, but many of the approaches could be incorporated in sharply focused research.

Fleming, Baum, and Singer draw upon a vast literature dealing with ways in which the physical environment and architectural design can affect stress levels and impose limits on or enhance interpersonal contacts. In the final chapter, Keisler reiterates the need for clearer delineation of causal ties before research findings can be made the basis for public policy decisions. He notes instances in which increasing support for those very low in support may actually be counterproductive.

Again and again the authors note that we must have more specificity, specificity in delineating facets of networks or relationships that are particularly consequential in buffering particular kinds of stressful experience and specificity in the examination of temporal sequences. Population studies almost never permit the disentanglement of processes and sequences of closely related developments. Studies of programs that provide supports are much more promising in this respect.

A topic that needs elaboration and further research is the interaction between persons' attributes and the social ties they establish and maintain. We know from longitudinal research that aloof or negativistic adolescents tend in adulthood to have fewer friends, to become divorced, and to be relatively dissatisfied in their work lives. The social supports that they can call upon as resources are, then, clearly not the same as

those of more positively oriented persons. We need to know what other consequences derive from such personal attributes in order to be certain that the relationship between supports and health is not a spurious one.

This is a book primarily for workers in the field seeking to learn how better to contribute to the production of further knowledge or to understand the questions that must be raised in interpreting research results. Some of the chapters touch so briefly on so many studies as to leave a reader who does not know the literature well with insufficient detail to understand the issues. But to an unusual degree this collection combines high-quality analysis with breadth and coherence. It is encouraging to note that increasingly the workers in this general field are reading beyond their own disciplines; although each discipline has its preferred literature, collections like this one and an increasing number of journals with a truly interdisciplinary orientation are combating provincialism.

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## Four-Dimensional Topology

**Instantons and Four-Manifolds.** DANIEL S. FREED and KAREN K. UHLENBECK. Springer-Verlag, New York, 1984. x, 232 pp., illus. \$15. Mathematical Sciences Research Institute Publications, vol. 1.

This book exposes the beautiful confluence of deep techniques and ideas from mathematical physics and the topological study of the differentiable structure of compact four-dimensional manifolds, compact spaces locally modeled on the world in which we live and operate. The volume is the outcome of a seminar on the work of Simon Donaldson, who utilized results in gauge field theory to prove the nonexistence of differentiable structures on certain compact 4-manifolds. This work is in sharp contrast to the earlier remarkable results of Michael Freedman, who completely classified (simply connected) compact topological 4-manifolds. As a result of these two lines of work there are at least two distinct calculi available on Euclidean 4-space; that is, Euclidean 4-space  $\mathbf{R}^4$  admits an exotic differentiable structure. It is only in dimension four that this remarkable phenomenon occurs. In all other dimensions Euclidean space possesses a unique differentiable structure. (Further refinements of Donaldson's work by Clifford Taubes imply that there is at least a continuum's worth of exotic differentiable