

PREFACE

The articles in this volume were written in response to the following hypothetical situation. A second year graduate student walks into the author's office and says: "I am thinking of doing a thesis in your area. Are there any good problems for me to work on?"

Leading astrophysical researchers answer the student's question in this collection by providing their views as to what are the most important problems on which major progress may be expected in the next decade. The authors summarize the current state of knowledge, observational and theoretical, in their areas. They also suggest the style of work that is likely to be necessary in order to make progress. The bibliographical notes at the end of each paper are answers to the parting question by the hypothetical graduate student: "Is there anything I should read to help me make up mind about a thesis?"

As everyone knows who reads a newspaper or listens to the daily news, astrophysics is in the midst of a technologically driven renaissance; fundamental discoveries are being made with astonishing frequency. Measured by the number of professional researchers, astrophysics is a small field. But, astronomical scientists have the entire universe outside planet earth as their exclusive laboratory. In the last decade, new detectors in space, on earth, and deep underground have, when coupled with the computational power of modern computers, revolutionized our knowledge and understanding of the astronomical world. This is a great time for a student of any age to become acquainted with the remarkable universe in which we live.

In order to make the texts more useful to students, each of the papers was "refereed" by cooperative graduate students and colleagues. On average, each paper was refereed four times. We would like to express our gratitude to the referees; their work made the papers clearer, more accessible, and in some cases, more correct. We are grateful to each of the authors for wonderful manuscripts and for their cooperation in what must have at times seemed like an endless series of iterations. The excellent quality of the final texts justifies their hard work.

In looking over the material as it now appears, we believe that these papers may have a wider readership than we originally anticipated. Most of the articles are accessible to junior or senior undergraduate students with a good science background. The book can therefore be useful as an undergraduate introduction to some of the important topics in modern astrophysics. We hope that readers who are

graduate students now or in the future will solve many of the problems listed here as unsolved. Anyone, from an undergraduate science major to a senior science faculty member, who would like to know more about some of the active areas of contemporary astrophysics can profit by reading about what these researchers think are the most important solvable problems.

The articles collected here were originally presented as invited talks at a conference entitled ‘Some Unsolved Problems in Astrophysics’ that was held at the Institute for Advanced Study on April 27-29, 1995. This conference was sponsored in part by the Sloan Foundation, to whom we express our gratitude. The dates for the conference were related to the 60th birthday (and 25th year at the Institute) of one of us (JNB), but nearly every effort was made to focus the meeting on science, not anniversaries. However, a large fraction of the attendees and speakers were alumni of the Institute’s postdoctoral program in astronomy and astrophysics.

The manuscript for this book was expertly prepared by Margaret Best. All of us are grateful to Maggie for her exceptional editorial and TeX skills and for her constant good nature.

John N. Bahcall, Jeremiah P. Ostriker
Princeton, June 1996

Unsolved Problems in Astrophysics

