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#### A review of: "Protostars and planets IV"

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*Book Review*

PROTOSTARS AND PLANETS IV

Eds. V. Mannings, A. P. Boss, and S. S. Russell

*Tucson: The University of Arizona Press. 2000. pp. 1,422 + 24 colour plates.  
Cloth, ISBN 0-8165-2059-3, \$95.00*

*(Received October 19, 2000)*

This book is a welcome publication and long awaited by many of us. It is really a great book because of both its huge page extent and prestigious authors. It is the latest volume in the internationally acclaimed Space Science Series with Tom Gehrels as the General Editor. In the brilliant collection of astronomical reviews published by the University of Arizona Press since 1974 which includes 29 books, there are many well-known books on planetary science and stellar physics. But the sub-series of 'Protostars and Planets' (PP) is unprecedented: PPI was published in 1978, PPII – 1985, PPIII – 1993, PPIV – 2000. The total extent of these four books is more than 5000 pages! The editors of the new volume are Vincent Mannings, a researcher at the Jet Propulsion Laboratory, California Institute of Technology; Alan P. Boss, a researcher at the Carnegie Institute of Washington, D.C.; and Sara S. Russell, a researcher at The Natural History Museum, London. This is a textbook and also a status report for every facet of research into the formation of stars and planets. Protostars and Planets IV brings together 167 authors who report on the most significant advances in the field since the publication of the previous volume in 1993. It contains more than 265 illustrations, including 24 colour plates and an interesting colour-picture cover.

There are 8 parts in the book:

*1. Molecular Clouds and Star Formation*

COMPRESSIBLE MHD TURBULENCE: IMPLICATIONS FOR MOLECULAR CLOUD AND STAR FORMATION; CHEMICAL EVOLUTION OF PROTOSTELLAR MATTER; FROM PRESTELLAR CORES TO PROTOSTARS: THE INITIAL CONDITIONS OF STAR FORMATION; THE STRUCTURE AND EVOLUTION OF MOLECULAR CLOUDS: FROM CLUMPS TO CORES TO THE IMF; THE STELLAR INITIAL MASS FUNCTION: CONSTRAINTS FROM YOUNG CLUSTERS, AND THEORETICAL PERSPECTIVES; THE FORMATION OF STELLAR CLUSTERS; OBSERVATIONS AND THEORY OF STAR CLUSTER FORMATION;

OBSERVATIONS OF INFALL IN STAR-FORMING REGIONS; POLARIZED LIGHT FROM STAR-FORMING REGIONS; THE LOW-MASS STELLAR POPULATION OF THE ORION OBI ASSOCIATION, AND IMPLICATIONS FOR THE FORMATION OF LOW-MASS STARS; HOT MOLECULAR CORES AND THE EARLIEST PHASES OF HIGH-MASS STAR FORMATION; THE FORMATION OF MASSIVE STARS.

### *2. Circumstellar Envelopes and Disks*

THE STRUCTURE AND EVOLUTION OF ENVELOPES AND DISKS IN YOUNG STELLAR SYSTEMS; EVOLUTION OF DISK ACCRETION; DISK DISPERSAL AROUND YOUNG STARS; EFFECTS OF ENERGETIC RADIATION IN YOUNG STELLAR OBJECTS; SPECTROSCOPY OF INNER PROTOPLANETARY DISKS AND THE STAR-DISK INTERFACE; HIGH-RESOLUTION OPTICAL AND NEAR-INFRARED IMAGING OF YOUNG CIRCUMSTELLAR DISKS; SUBARCSECOND MILLIMETER AND SUBMILLIMETER OBSERVATIONS OF CIRCUMSTELLAR DISKS; DUST PROPERTIES AND ASSEMBLY OF LARGE PARTICLES IN PROTOPLANETARY DISKS; PROPERTIES AND EVOLUTION OF DISKS AROUND PRE-MAIN-SEQUENCE STARS OF INTERMEDIATE MASS; TRANSPORT PROCESSES IN PROTOSTELLAR DISKS; INFALLING PLANETESIMALS IN PRE-MAIN-SEQUENCE STELLAR SYSTEMS; PLANETARY MATERIAL AROUND MAIN-SEQUENCE STARS.

### *3. Young Binaries*

MULTIPLE FRAGMENTATION OF PROTOSTARS; YOUNG BINARY STARS AND ASSOCIATED DISKS; INTERACTIONS OF YOUNG BINARIES WITH DISKS.

### *4. Jets and Outflows*

DISK WINDS AND THE ACCRETION-OUTFLOW CONNECTION; X-WINDS: THEORY AND OBSERVATIONS; COLLIMATION AND PROPAGATION OF STELLAR JETS; SHOCK STRUCTURES AND MOMENTUM TRANSFER IN HERBIG-HARO JETS; MOLECULAR OUTFLOWS FROM YOUNG STELLAR OBJECTS.

### *5. Early Solar System and Planet Formation*

THE FU ORIONIS PHENOMENON AND SOLAR NEBULA MATERIAL; FORMATION OF CHONDRULES AND CAIS: THEORY VS. OBSERVATION; EXTINCT RADIONUCLIDES AND THE ORIGIN OF THE SOLAR SYSTEM; TIMESCALES OF ACCRETION AND DIFFERENTIATION IN THE EARLY SOLAR SYSTEM: THE METEORITIC EVIDENCE; METEORITICAL AND ASTROPHYSICAL CONSTRAINTS ON THE OXIDATION STATE OF THE SOLAR NEBULA; THE OUTER SOLAR SYSTEM: CHEMICAL CONSTRAINTS AT LOW TEMPERATURES ON PLANET FORMATION; GIANT PLANET FORMATION; ORBITAL EVOLUTION AND PLANET-STAR TIDAL INTERACTION; DISK-PLANET INTERACTIONS AND THE FORMATION OF PLANETARY SYSTEMS.

### *6. Comets and the Kuiper Belt*

COMETS: A LINK BETWEEN INTERSTELLAR AND NEBULAR CHEMISTRY; PHYSICAL NATURE OF THE KUIPER BELT; DYNAMICS OF THE KUIPER BELT; FORMATION AND COLLISIONAL EVOLUTION OF THE EDGEWORTH-KUIPER BELT.

### *7. Extrasolar Planets and Brown Dwarfs*

EXTRASOLAR PLANETS AROUND MAIN-SEQUENCE STARS; BROWN DWARFS; NEW IDEAS IN THE THEORY OF EXTRASOLAR GIANT PLANETS AND BROWN DWARFS.

### *8. Initial Conditions for Astrobiology*

PLANETARY HABITABILITY AND THE ORIGINS OF LIFE.

The 49 chapters describe the context and progress for observational and theoretical studies of the structure, chemistry, and dynamics of molecular clouds; the collapse of cores and the formation of protostars; the formation and properties of young binary stars; the properties of winds, jets, and molecular outflows from young stellar objects; the evolution of circumstellar envelopes and disks; grain growth in disks and the formation of planets; and the properties of the early Solar nebula.

'Protostars and Planets IV' reflects improvements in observational techniques and the availability of new facilities such as the Infrared Space Observatory, the refurbished Hubble Space Telescope, and the 10-m Keck telescopes. Advances in computer technology and modeling methods have benefited theoretical studies of molecular clouds, star formation, and jets and disks, while recent analyses of meteorites yield important insights into conditions and processes within our Sun's early protoplanetary disk.

'Protostars and Planets IV' is also the first book to include chapters describing the discoveries of extrasolar planets, brown dwarfs, and Edgeworth-Kuiper Belt objects, and the first to include high-resolution optical and near-infrared images of protoplanetary disks. This volume summarizes a field in which progress has been substantial since the publication of its predecessor. Almost each of its parts might be a very interesting separate book. Then we have 'a few in one' (the total price is only \$95)!

As a Russian person I must note the Dedication of the book, which is delightful for all Russian astronomers: 'We dedicate this volume to V.S. Safronov for his pioneering work on planet formation theory'. Prof. Safronov was active scientist (see PP III) until his death in September 1999 at the age of 82 years. But our cosmogonical traditions are not lost: there are a few Russian names among the authors contributing to the volume.

This volume gives us the new insights on cosmogony. A close interaction between observations, measurements, theory, and numerical modeling plays an important role in advancing our understanding of star and planet formation. During next decade 'Protostars and Planets IV' will be our most authoritative source in this field. This book is an unsurpassed reference not only for established researchers but also for younger scientists whose imagination and work will lead to tomorrow's discoveries.

V. G. SURDIN