

34. INTERSTELLAR MATTER AND PLANETARY NEBULAE
(MATIÈRE INTERSTELLAIRE ET NÉBULEUSES PLANÉTAIRES)

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1. Introduction

(G.B. Field)

It is now recognized that diffuse matter in space plays a decisive role in the evolution of our Galaxy and of similar galaxies. Primordial gas--together with gas ejected in planetary nebulae, stellar winds, novae, supernovae, and other types of stars--has accumulated to form a complex medium containing regions with densities ranging from 10^{-3} to 10^6 particles cm^{-3} and with temperatures ranging from 10 K to 10^6 K. From time to time, part of the interstellar medium collapses to form stars. In order to understand the evolution of the Galaxy, it is essential to understand how energy, mass, trace elements, and dust grains are deposited into the interstellar medium by stars. It is also essential to understand the mechanisms that initiate star formation in certain regions, and how the ensuing collapse develops in space and time.

Classical astronomy was restricted to optical observations, but recent advances in radio, infrared, ultraviolet, and X-ray techniques have all played a role in elucidating key phenomena. For example, radio and infrared techniques, by penetrating obscuring interstellar dust, have provided new insights into extremely dense regions and young stars, while radio and X-ray techniques have furnished new information about supernova remnants, which are major contributors of energy and of heavy elements to the interstellar medium. Ultraviolet and soft X-ray observations have disclosed interstellar regions of anomalously high temperature and velocity dispersion, conditions which may be created by supernovae or by the winds of early-type stars. Optical observations (particularly of planetary nebulae and of H II regions) are now being compared with detailed computer calculations, incorporating the most recent atomic data, of the emergent emission-line spectrum.

The present report, documenting developments in these areas in the period 1976 to 1978, was written wherever possible by members of the Organizing Committee. Each author's section is essentially self-contained. Because the Report of Commission 40 includes a comprehensive bibliography of Radio Astronomy, only key references from that field appear in the present Report.

A selection of relevant books, conference proceedings, and review articles and catalogues published since 1975 is presented below; many others, particularly the more specialized, are mentioned in the appropriate sections of the Report. Most works are cited in terms of their Astronomy and Astrophysics Abstracts reference numbers.

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