V. PHYSICAL PROPERTIES OF THE INTERSTELLAR MEDIUM

INTRODUCTION TO THE SESSION

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Five years ago, at the previous IAU Symposium (No. 60) on the galaxy, most of us pictured the interstellar medium (ISM) as a mainly quiescent medium which evolved by orderly processes--the "steady state" ISM. Radhakrishnan reviewed the "intercloud medium" which was warm (some few thousand degrees), rarefied (some few tenths cm^{-3}), uniformly - distributed, partly ionized, and responsible for the smoothly-distributed pulsar dispersion measures and Faraday rotations. Heiles reviewed the "clouds," which had densities of tens cm^{-3}, temperatures of tens K, and nonspherical shapes. These two components were in approximate pressure equilibrium; Grewing, in his review of heating mechanisms, emphasized pervasive, nonvarying processes.

We have since learned that this picture is drastically incomplete. Observationally, the discoveries of interstellar OVI (Jenkins and Meloy, 1974; Jenkins, 1978) and of diffuse X-ray emission from large areas of sky (see the review by Tanaka and Bleeker, 1977) showed that most, or at least much, of the volume relatively close to the sun is filled with hot ($\sim 10^6$ K), highly rarefied (~ 0.003 cm^{-3}) gas. Theoretically, Cox and Smith (1974) showed that type II supernovae generate cavities which expand to radii of order 100 pc and which remain in existence for about 10^7 yr. The total volume occupied by such cavities is a significant fraction of the total interstellar volume in the galaxy. The insides of these cavities contain the hot, rarefied gas of the sort observed. The first steps towards a comprehensive theoretical picture have begun (Smith, 1977; McKee and Ostriker, 1977).

We conclude that much of the volume is occupied by this hot, rarefied gas, and that supernovae have a dominant effect on the ISM.

W. B. Burton (ed.), The Large-Scale Characteristics of the Galaxy, 243–244.

https://doi.org/10.1017/S0074180900014571 Published online by Cambridge University Press

We note that this is true even in the "Great Galactic Ring" where the dense molecular clouds are concentrated; they occupy only about 1% of the volume.

This picture is hardly complete and provides a great many fundamental questions for us. Some of my favorites include the following. Where are the warm HI, the electrons, and the magnetic fields which produce the smooth distributions previously so well accounted for by the intercloud medium? How do spiral density wave shocks fit into this picture? And, of course, the usual question: how do the molecular clouds, which are so dense and massive, form?

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