

Preface

... and so there ain't nothing more to write about, and I am rotten glad of it, because if I'd a knowed what a trouble it was to make a book I wouldn't a tackled it, and ain't a-going to no more...

Mark Twain in *Huckleberry Finn*

Suspected but undetected only a bit more than a century ago, the matter between the stars in our Galaxy and others is a vast medium of extremes. Hendrik van de Hulst once described the interstellar medium as a place where an atom could sit for a million years and still act spontaneously. It is fuel for the birth of stars and the disposal site of their nucleosynthesis, where lengths are measured in parsecs or kiloparsecs yet whose energetics are governed on the scale of solar systems. Its kinetics are nearly collisionless yet its dynamical state is the result of large-scale ordering as if a fluid. Its density varies by five to six orders of magnitude in the diffuse phase and even more in the densest clouds. Its velocities range from diffusion to hypersonic, and its temperatures range from a few K to 10^7 K, from ices to plasmas.

During the last half-century, the interstellar medium has been intensively studied and its complexity increasingly appreciated. The launching of the *Planck* and *Herschel* orbiting observatories has lent a new, multi-wavelength approach to studies of the interstellar medium, and the astounding databases that are now available from radio waves to gamma-rays will keep astrophysicists busy for decades to come.

Most of the recent work on the interstellar medium has focused on star and planetary formation. Necessarily, these studies have concentrated on the denser parts of molecular clouds and cores where these objects form. However, both of us have spent a good portion of our careers thinking about the more diffuse molecular and atomic gas, where star formation plays no role. In light of this, we decided to share some of our thoughts and views on this somewhat neglected component of the Galaxy.

Our goal in this book is to present a broad view of the diffuse interstellar medium, with emphasis on diffuse and translucent molecular gas. The book is not intended to be a textbook or a lengthy review; rather, it's our point of view of the diffuse interstellar medium as our experiences led us to see it. For this reason, for example, we have chosen to not discuss the physics of shocks in the diffuse medium. Although they play an important role in the dynamics and energetics of the ISM, we

concentrate on the neutral and molecular gas, for which they are less important. This book is intended for graduate students who are entering the field and postdocs who are switching fields. It is meant to be accessible to someone who does not necessarily have the astrophysical background. However, some prior knowledge of radiative transfer and the theory of turbulence (Chaps. 2 and 11) is required as our treatments of these topics presuppose some basic familiarity with them.

The seeds for this book were planted nearly 20 years ago from conversations between one of us (LM) and Dap Hartmann and Eugene de Geus. The original plan was to produce a book on high-latitude molecular clouds. For a number of reasons, that work was stillborn. The idea was resurrected about 5 years ago when the two of us decided, with encouragement from Butler Burton, to turn some of our research on high-latitude translucent clouds into a more complete treatment than was possible in a review article. Given the work we have done over the last 15 years (much of which with our colleague, Ted LaRosa), we decided to use the high-latitude molecular clouds as illustrations of many of the concepts we wished to discuss. For most of these objects, gravity does not dominate; instead, they show flows and are perhaps the best objects to study the original turbulence that gave rise to them, undisturbed by star formation and its effects.

We have learned so much from our colleagues and students over the years. To thank all of them would be impossible. We limit ourselves to mentioning those who interacted with us particularly on the topics of this book: Mike A'Hearn, Gianni Aiello, Joao Alves, Tom Bania, Giuseppe Bertin, Claude Bertout, John Black, Leo Blitz, Jan Brand, J.-P. Caillault, Bruce Elmegreen, Nye Evans, Edith Falgarone, Steve Federman, Daniele Galli, Riccardo Giovanelli, Dap Hartmann, Thomas Hartquist, Mike Hauser, Carl Heiles, Mark Heyer, Anthony Jones, Namir Kassim, Elizabeth Lada, Alex Lazarian, Mordecai-Mark Mac Low, Lee Mundy, Joe Onello, Jan Palous, Francesco Pegoraro, John Raymond, Tim Robishaw, Göran Sandell, John Scalo, Bob Silverberg, Mattia Sormani, Steve Stahler, Snezana Stanimirovic, Pat Thaddeus, Barry Turner, Enrique Vasquez-Semadeni, Fran Verter, Malcolm Walmsley, Jan Wouterloot, and, our dear friend and colleague, Ted LaRosa.

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