Observational Molecular Astronomy

Exploring the Universe Using Molecular Line Emissions

Molecular line emissions offer researchers exciting opportunities to learn about the evolutionary state of the Milky Way and distant galaxies. This text provides a detailed introduction to molecular astrophysics and an array of useful techniques for observing astronomical phenomena at millimetre and submillimetre wavelengths. After discussing the theoretical underpinnings of molecular observation, the authors catalogue suitable molecular tracers for many types of astronomical regions in local and distant parts of the Universe, including cold gas reservoirs primed for the formation of new stars, regions of active star formation, giant photon-dominated regions, and near active galactic nuclei. Further chapters demonstrate how to obtain useful astronomical information from raw telescope data while providing recommendations for appropriate observing strategies. Replete with maps, charts, and references for further reading, this handbook will suit research astronomers and graduate students interested in broadening their skills to take advantage of the new facilities now coming online.

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Contents

List of Illustrations

List of Tables

Preface

This is a handbook for those astronomers who wish to use molecular line emissions as probes of astronomical sources. These sources may include molecular clouds and star-forming regions, circumstellar envelopes, and ejecta from evolved stars. Molecular lines are particularly useful in deconvolving complex emissions from distant unresolved galaxies.

This is not a textbook; it does not present detailed explanations and derivations. Textbook information can be found in the Further Reading sections at the end of each chapter. This handbook aims to provide a background of understanding so that the observer can begin to address the following questions:

- Why are different astronomical regions best traced in lines from different molecules?
- Which are the most suitable molecular tracers for studying the observer's selected sources?
- How does the observer convert raw telescope data into astrophysically useful information?
- How can the most complete physical description be extracted from the data?