**IBEX – Direct Sampling the Local Interstellar Medium**

Dave McComas (Southwest Research Institute and University of Texas at San Antonio)

The interstellar medium arises from material ejected as stellar winds and from cataclysmic phenomena such as novae and supernovae. The Interstellar Boundary Explorer (IBEX) directly observes neutral atoms from the local interstellar medium surrounding the Sun that penetrate our heliosphere and survive into Earth’s orbit. This material is partially ionized and the ions and neutrals interact with each other, coupling these components together and allowing various aspects of the plasma interactions between the interstellar medium and heliosphere to also imprint themselves onto the observed neutral atom distributions.

IBEX interstellar neutral observations now span six years (2009-2014) and provide a wealth of new information about the very local interstellar medium and its heliospheric interaction. In this *Astrophysical Journal Supplement* special issue, we collect together 14 new studies that describe the IBEX interstellar neutral results over this interval and provide other supporting and relevant observational and theoretical results. The Table, taken from the first paper in this issue, lists the titles and first authors of each of the contributions; that paper also provides an overview and summary of the entire special issue and recommends the best combined interstellar parameters currently available for other researchers to use for theory and modeling studies. Each of the papers in this special issue provides great insight into various detailed aspects of the observations, interpretations, and theories related to IBEX’s unique interstellar neutral data set.

Collectively, the 14 studies in this special issue, along with the prior papers, open a completely new window on the local interstellar medium in terms of its composition, properties, and even the processes at work in the interstellar region around our heliosphere. These observations provide the ground truth for understanding the interstellar medium more generally, which is critical for stellar and planetary system formation. They also inform the formation of astrospheres around other stars and a deeper understanding of the tenuous material throughout our galaxy and the other galaxies beyond.

|  |  |
| --- | --- |
| 1. Local Interstellar Medium: Six Years of Direct Sampling by IBEX  | McComas |
| 2. The Analytical Structure of the Primary Interstellar Helium Distribution Function in the Heliosphere | Lee |
| 3. Interstellar Flow and Temperature Determination with IBEX: Robustness and Sensitivity to Systematic Effects | Möbius |
| 4. Determination of Interstellar He Parameters Using 5 Years of Data From IBEX: Beyond Closed-form Approximations | Schwadron |
| 5. Interstellar Neutral Helium in the Heliosphere from IBEX Observations. I. Uncertainties and Backgrounds in the Data and Parameter Determination Method | Swaczyna |
| 6. Interstellar Neutral Helium in the Heliosphere from IBEX Observations. II. The Warsaw Test Particle Model (WTPM) | Sokół |
| 7. Interstellar Neutral Helium in the Heliosphere from IBEX Observations. III. Mach Number of the Flow, Velocity Vector, and Temperature from the First Six Years of Measurements | Bzowski |
| 8. The Interstellar Neutral He Haze in the Heliosphere: What Can We Learn? | Sokół |
| 9. Can IBEX Detect Interstellar Neutral Helium or Oxygen from Anti-ram Directions? | Galli |
| 10. Exploring the Possibility of O and Ne Contamination in Ulysses Observations of Interstellar Helium | Wood |
| 11. 3D Kinetic-MHD Model of the Global Heliosphere with the Heliopause-surface Fitting | Izmodenov |
| 12. Impact of the Solar Radiation Pressure on Fluxes of Interstellar Hydrogen Atoms Measured by IBEX | Katushkina |
| 13. Statistical Analysis of the Heavy Neutral Atoms Measured by IBEX | Park |
| 14. Impact of Planetary Gravitation on High-precision Neutral Atom Measurements | Kucharek |