Pseudo IBEX data Generator and Model Interface (PIGMI)

Christina Prested, Jacob Heerikhuisen, Dave McComas, Jamison Passuite, Brent Randol, Michelle Reno, Nathan Schwadron and Brian Stuart

1 Boston University, Boston, MA; 2 University of California, Riverside, CA; 3 Southwest Research Institute, San Antonio, TX

Overview

IBEX will image the energetic neutral atoms (ENAs) that illuminate the global structure and properties of the termination shock. In preparation for this mission, a series of goals are being met, guiding the effort to characterize future IBEX data. Synthetic ENA data are being generated to simulate the range of expected count rates from IBEX’s Hi and Lo ENA sensors, including viewing times in each all-sky pixel. The synthetic data are generated from current models of ENA emissions based on global simulations of the heliosphere and are being used to optimize the segregation between magnetospheric, heliospheric ENAs, and background sources. From this synthetic data new all-sky maps are produced and compared to the original model ENA maps as a fidelity check. Finally, various heliospheric model results should compared in order to understand the sensitivity of ENA maps to internal and external boundary conditions.

Background

Heliospheric ENAs are primarily produced by charge exchange between energetic solar wind ions and interstellar neutral atoms beyond the termination shock. By studying the distribution of these ENAs in energy and geometric space we can learn about properties of the termination shock and the local interstellar medium.

In order to gather global information about asymmetries of the termination shock, IBEX will sweep out an all-sky map in 6 months. Since the Earth’s magnetosphere is a large producer of local ENAs, we will not use count rates produced while the satellite is in or looking at the magnetosphere.

The IBEX Hi and Lo sensors will indirectly measure the strength of the termination shock by recording the distribution of ENAs in energy space. Further information about the boundary of the heliosphere will be found by comparing the IBEX results with models of the interaction between the LISM and solar wind.

Science Questions

1. What is the global strength and structure of the termination shock?
2. How are energetic protons accelerated at the termination shock?
3. What are the global properties of the solar wind flow beyond the termination shock and in the heliosheet?
4. How do energy distributions of ENAs differ within and beyond the termination shock?
5. What is the relationship between ENAs and shock parameters such as shock speed?

Conclusions

We are currently creating a well-defined interface that connects global simulations of heliosphere with the ENA emissions and the synthetic IBEX data products that would result. This basic tool will create a standardized mechanism to inter-compare the ENA predictions from an array of different global simulations, to prepare to infer global properties of the interstellar interaction from IBEX data products, and to set the stage for a wealth of unanticipated discoveries from IBEX.

Goal: Develop algorithm for segregating magnetospheric, heliospheric, and foreground ENAs.

Goal: Generate synthetic all-sky ENA maps to test fidelity of PIGMI process.

Goal: Develop synthetic data

Goal: IBEX Global Maps

Overview

IBEX will image the energetic neutral atoms (ENAs) that illuminate the global structure and properties of the termination shock. In preparation for this mission, a series of goals are being met, guiding the effort to characterize future IBEX data. Synthetic ENA data are being generated to simulate the range of expected count rates from IBEX’s Hi and Lo ENA sensors, including viewing times in each all-sky pixel. The synthetic data are generated from current models of ENA emissions based on global simulations of the heliosphere and are being used to optimize the segregation between magnetospheric, heliospheric ENAs, and background sources. From this synthetic data new all-sky maps are produced and compared to the original model ENA maps as a fidelity check. Finally, various heliospheric model results should compared in order to understand the sensitivity of ENA maps to internal and external boundary conditions.

Background

Heliospheric ENAs are primarily produced by charge exchange between energetic solar wind ions and interstellar neutral atoms beyond the termination shock. By studying the distribution of these ENAs in energy and geometric space we can learn about properties of the termination shock and the local interstellar medium.

In order to gather global information about asymmetries of the termination shock, IBEX will sweep out an all-sky map in 6 months. Since the Earth’s magnetosphere is a large producer of local ENAs, we will not use count rates produced while the satellite is in or looking at the magnetosphere.

The IBEX Hi and Lo sensors will indirectly measure the strength of the termination shock by recording the distribution of ENAs in energy space. Further information about the boundary of the heliosphere will be found by comparing the IBEX results with models of the interaction between the LISM and solar wind.

Science Questions

1. What is the global strength and structure of the termination shock?
2. How are energetic protons accelerated at the termination shock?
3. What are the global properties of the solar wind flow beyond the termination shock and in the heliosheet?
4. How do energy distributions of ENAs differ within and beyond the termination shock?
5. What is the relationship between ENAs and shock parameters such as shock speed?

Conclusions

We are currently creating a well-defined interface that connects global simulations of heliosphere with the ENA emissions and the synthetic IBEX data products that would result. This basic tool will create a standardized mechanism to inter-compare the ENA predictions from an array of different global simulations, to prepare to infer global properties of the interstellar interaction from IBEX data products, and to set the stage for a wealth of unanticipated discoveries from IBEX.

Goal: Develop algorithm for segregating magnetospheric, heliospheric, and foreground ENAs.

Goal: Generate synthetic all-sky ENA maps to test fidelity of PIGMI process.

Goal: Develop synthetic data

Goal: IBEX Global Maps

Overview

IBEX will image the energetic neutral atoms (ENAs) that illuminate the global structure and properties of the termination shock. In preparation for this mission, a series of goals are being met, guiding the effort to characterize future IBEX data. Synthetic ENA data are being generated to simulate the range of expected count rates from IBEX’s Hi and Lo ENA sensors, including viewing times in each all-sky pixel. The synthetic data are generated from current models of ENA emissions based on global simulations of the heliosphere and are being used to optimize the segregation between magnetospheric, heliospheric ENAs, and background sources. From this synthetic data new all-sky maps are produced and compared to the original model ENA maps as a fidelity check. Finally, various heliospheric model results should compared in order to understand the sensitivity of ENA maps to internal and external boundary conditions.

Background

Heliospheric ENAs are primarily produced by charge exchange between energetic solar wind ions and interstellar neutral atoms beyond the termination shock. By studying the distribution of these ENAs in energy and geometric space we can learn about properties of the termination shock and the local interstellar medium.

In order to gather global information about asymmetries of the termination shock, IBEX will sweep out an all-sky map in 6 months. Since the Earth’s magnetosphere is a large producer of local ENAs, we will not use count rates produced while the satellite is in or looking at the magnetosphere.

The IBEX Hi and Lo sensors will indirectly measure the strength of the termination shock by recording the distribution of ENAs in energy space. Further information about the boundary of the heliosphere will be found by comparing the IBEX results with models of the interaction between the LISM and solar wind.

Science Questions

1. What is the global strength and structure of the termination shock?
2. How are energetic protons accelerated at the termination shock?
3. What are the global properties of the solar wind flow beyond the termination shock and in the heliosheet?
4. How do energy distributions of ENAs differ within and beyond the termination shock?
5. What is the relationship between ENAs and shock parameters such as shock speed?

Conclusions

We are currently creating a well-defined interface that connects global simulations of heliosphere with the ENA emissions and the synthetic IBEX data products that would result. This basic tool will create a standardized mechanism to inter-compare the ENA predictions from an array of different global simulations, to prepare to infer global properties of the interstellar interaction from IBEX data products, and to set the stage for a wealth of unanticipated discoveries from IBEX.

Goal: Develop algorithm for segregating magnetospheric, heliospheric, and foreground ENAs.

Goal: Generate synthetic all-sky ENA maps to test fidelity of PIGMI process.

Goal: Develop synthetic data

Goal: IBEX Global Maps