Analysis of Solar Lyman-Alpha Backscatter Radiation in the Heliosphere

Brian Fayock, Physics/CSPAR

Overview
The solar wind creates a bubble called the heliosphere that shields our solar system from interstellar plasma and magnetic fields as well as most of the cosmic rays and dust that comprise the local interstellar medium (LISM). Multiple boundaries are created as a result of this interaction which are defined by regions corresponding to the characteristics of the particles within.

Key Findings
To ensure meaningful results, tests on an analytical density profile were performed to obtain an understanding of how photons would interact under expected changes in density. The profile is half the period of a sine function with a Gaussian peak to act as the hydrogen wall. The density profile and primary scatter results are on the left, and the simulation of spacecraft view (looking at and away from the sun) are on the right. Model data results are below.

Impact
This research has the potential to lead to a better understanding of the role of interstellar neutral H, provide a deeper appreciation for importance of radiative transfer in interpreting multi-fluid and kinetic global MHD models with time dependence, and lead to further development of Lyman-alpha as a useful tool for data acquisition and analysis in future NASA missions.

Explanation
Various NASA spacecraft have been collecting UV data for quite some time. Most of this data has been unexplored in terms of Lyman-alpha backscatter analysis. This research will make use of this data by comparing it to simulated results from global models of the heliosphere, thereby providing further insight into the global structure of the heliosphere.

Acknowledgements
Many thanks to the advising of Dr. Gary Zank, to Dr. Jacob Heerikhuisen for providing model data, and to Alabama EPSCoR for funding some of my research.