Project Details

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Program Element: Focused Science Topic

Topic: Origin and Nature of the Slow Solar Wind, Associated Interplanetary Structures, and SEP Transport

Project Title:
Characterizing the Origin and Nature of Slow Wind Sources During Solar Cycle 23 and 24

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Summary:
The slow wind is a sizeable component of the solar wind and plays a fundamental role in shaping the interplanetary environment. Yet, the slow wind has not been studied with the same detail as the fast solar wind because of its complexity, its variability, and the apparent multiple source regions. In particular, the source regions and the heating and acceleration mechanisms of the slow wind have not been identified. Understanding its origin and forecasting its variability are fundamental requirements for predicting the effects of the Sun on the heliosphere, Earth's upper atmosphere, and interplanetary space.

In the proposed investigation we will use data from Hinode, STEREO, and SOHO to characterize the sources of the slow wind during representative time periods of solar cycles 23 and 24. The main focuses of our investigation will be: 1) to identify tracers of the source regions of the slow wind; 2) to measure the overall physical properties of streamers as a function of time, latitude, and heliocentric distance using spectroscopic diagnostics from Hinode and SOHO spectrometers, and Hinode, STEREO, and SOHO imagers; 3) to investigate the heating and acceleration mechanisms of the slow wind by using the measured quantities to test theoretical models.

Given the strong dependence of the slow wind on the solar cycle, it is important to compare the properties of the slow wind during minimum periods where it represent less than 20% of the solar wind, to solar maximum periods where the slow wind dominates. In particular, the unusual conditions of the solar atmosphere during the current minimum of solar cycle 24 represent a unique opportunity to investigate the dependence of the slow wind on streamer parameters. The comparison of data from multiple spacecraft along 14 years of continuous observations encompassing the entire solar cycle 23 and the minimum of solar cycle 24 will provide for the first time an opportunity to map the slow wind evolution.

Publication References:

no references