# Project Details

**ROSES ID:** NRA-03-OSS-01
**Selection Year:** 2004
**Program Element:** Independent Investigation: LWS

**Project Title:**
Neil Sheeley

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**Summary:**
OBJECTIVES: Geomagnetic activity is closely correlated with the strength of the interplanetary magnetic field (IMF), which in turn varies in proportion to the Sun's total open flux. Active region emergence, photospheric transport processes, and coronal mass ejections (CMEs) can cause the total open flux to increase or decrease. In situ measurements indicate that the IMF strength can vary by a factor of 2 on timescales of months, consistent with source surface extrapolations of the photospheric field. However, direct observational evidence for the opening up and closing down of magnetic flux in the corona or at 1 AU has been hard to find and/or interpret, leading to suggestions that the open flux remains constant, simply undergoing footpoint exchanges with closed loops. Our objectives are (1) to identify, using photospheric, coronal, and interplanetary data, the observational signatures of the opening-up and closing-down of flux and of footpoint exchanges; and (2) to determine whether the locations, times, and occurrence rates of such events are consistent with the predictions of the photospheric flux transport and potential-field source-surface models. APPROACH: To search for signatures of the opening-up and closing-down of magnetic flux and of footpoint exchanges, we will make use of the large variety of data accumulated during solar cycle 23, including coronagraph, EUV, and photospheric field observations from SOHO, near-Earth magnetometer, plasma, and composition data from ACE and WIND, and ground-based magnetograms and He I 10830 spectroheliograms. We will determine if relationships exist between different types of events that might be associated with changes in the open flux, including (1) increases or decreases in the radial IMF strength, (2) photospheric flux emergence, (3) changes in coronal hole boundaries, (4) gradual outward expansions of helmet streamers, (5) CMEs, (6) streamer blobs, (7) coronal inflows, (8) electron heat flux dropouts and other plasma sheet variations at 1 AU. In addition, we will employ flux transport simulations and source surface extrapolations to predict changes in open field regions, and test these predictions against the observations. RELEVANCE: By identifying and elucidating the mechanisms that regulate the IMF strength at Earth, the proposed cross-disciplinary research addresses Objective 1 of the LWS TR&T program and at least one of the Specific Research Topics of High Current Interest ("The magnetic field topology connecting the photosphere to the corona"); also OSS Strategic Goal I, SEC Theme, RFA 1(a), Goal II, SEC Theme, RFA 1(a), 2(a).

# Publication References:

**Summary:** ''

**Reference:** Neil Sheeley / Naval Research Laboratory-Observational Signatures of Time Variations in the Sun's Open Magnetic Flux