

Project Details

ROSES ID: NNH15ZDA001N

Selection Year: 2015

Program Element: Focused Science Topic

Topic: The Solar-Stellar Connection

Project Title:

The Heliosphere in Time: Scaling Heliospheric Parameters with Stellar Evolution of Solar Analogs and Studying Heliospheric Consequences of Young Active Suns

PI Name: Ofer Cohen

PI Email: ocohen@cfa.harvard.edu

Affiliation: Smithsonian Institution/Smithsonian Astrophysical Observatory

Project Member(s):

- Toth, Gabor ; Co-I; University Of Michigan, Ann Arbor
- Drake, Jeremy J.; Co-I; Smithsonian Institution/Smithsonian Astrophysical Observatory
- Kashyap, Vinay ; Co-I; Smithsonian Institution/Smithsonian Astrophysical Observatory
- Sokolov, Igor ; Co-I/Institutional PI; University Of Michigan, Ann Arbor
- Gombosi, Tamas I.; Co-I; University Of Michigan, Ann Arbor
- van der Holst, Bartholomeus ; Co-I; University Of Michigan, Ann Arbor

Summary:

We propose to use the Space Weather Modeling Framework (SWMF) to study the state of the heliosphere and the interplanetary environment for different stages of the Sun through its evolution. The study will include: simulating the stellar winds of solar analogs at different ages, driven by low-resolution magnetograms now available for significant number of stars; studying young and active, fast-rotating suns, and examining their flares and superflares by simulating their Coronal Mass Ejections (CMEs); using both optical and X-ray observations of stars to constrain flaring rates; investigating other possible dynamic mechanisms to trigger superflares (such as the azimuthal stretching of coronal loops as the result of the fast rotation); studying the role of CMEs in the solar mass loss rate over time (potentially important for the faint young Sun paradox); and investigating the cosmic ray/SEP generation, transport, and modulation for different ages of the Sun in quiescent and superflare conditions. The end result of the project will be a complete, physics-based description of the heliosphere through time and a general scaling of the interplanetary environment, in which the Earth and the other planets were formed.

Publication References:

Summary: Stellar coronae and winds of solar analogs

Reference: Pognan Q.; Garraffo C.; Cohen O.; Drake J. J.; (2018). The Solar Wind Environment in Time. Astrophysical Journal, 856, 53, doi: 10.3847/1538-4357/aaebbb

- **Investigation Type:** Simulations
- **Domains:** Sun
- **Model Types:** MHD