

## Project Details

**ROSES ID:** NNH10ZDA001N

**Selection Year:** 2011

**Program Element:** Cross-Discipline Infrastructure Building Programs

**Project Title:**

From Sun to Ice: A Cross-Disciplinary Workshop on the Causes and Consequences of Extreme Solar Events

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**Summary:**

Extreme solar eruptive events, while rare, can have monumental effects all the way from the Sun to Earth's polar ice caps. They have been implicated in the depletion of ozone and cloud formation, and their occurrence can be seen directly in ice core records spanning more than 400 years into the past. Their effects at other planets, and elsewhere in the solar system can be important, and violent flare activity can even be observed at other stars. Yet the basic physical processes that lead to these events, the acceleration and transport of energetic particles, and their effects at Earth and elsewhere remain poorly understood. With recent advances in theory and the availability of new datasets, together with society's continually increasing reliance on technology, a coordinated study of extreme events and their impacts at Earth is both timely and necessary. We propose to convene two workshops on this interdisciplinary topic to address several fundamental questions, including: (1) What makes these events extreme? (2) Why are some events extreme in some aspects (e.g., CME speed) but not others (e.g., SEP fluxes)? (3) How should the solar activity record in ice cores be interpreted? and (4) What possible effects could the so-called "super-storms," such as the Carrington event of 1859, have had on ozone levels? To ensure the success of the workshops, we will invite leading experts representing experimenters, data analysts, theoreticians, and modelers in a range of sub-disciplines, including solar, stellar, planetary, heliospheric, magnetospheric, ionospheric physics, astrophysics, and ice-core chemistry. In addition to studying basic science questions in the chain of events from the Sun to the ice, we will focus on the boundaries between the different regions, where there has been little cross fertilization of ideas, and groups have often reached substantially different conclusions, based on the same available measurements. We anticipate that the first workshop will introduce the main outstanding issues in each field, define the boundaries between each field, and identify how cross-disciplinary studies can lead to new insight. During the second workshop (approximately one year later), the progress made during the previous year will be reported and new questions and issues resulting from these studies will be addressed.

## Publication References:

**Summary:** no summary

**Reference:** Riley, Pete; Caplan, Ronald M.; Giacalone, Joe; Lario, David; Liu, Ying; (2016), Properties of the Fast Forward Shock Driven by the July 23 2012 Extreme Coronal Mass Ejection, The Astrophysical Journal, Volume 819, Issue 1, article id. 57, 11 pp, doi: 10.3847/0004-637X/819/1/57