IRIS Observations of a Novel, Hybrid Prominence-Coronal Rain Complex in a Supra-arcade Fan Geometry

Liu, Wei (1,2), weiliu@lmsal.com; Xudong Sun (2); Patrick Antolin (3); Thomas Berger (4); and Takenori Okamoto (5).
(1) Lockheed Martin Solar and Astrophysics Laboratory, Palo Alto, CA, USA
(2) Stanford University, Stanford, CA, USA
(3) National Astronomical Observatory of Japan, Mitaka, Tokyo, Japan
(4) NOAA Space Weather Prediction Center, Boulder, CO, USA
(5) Institute of Space and Astronautical Science, Japan Aerospace Exploration Agency, Yoshinodai, Sagamihara, Japan

Solar prominences and coronal rain are intimately related phenomena, both involving cooling condensation as part of the return flow of the chromosphere-corona mass cycle (e.g., Antolin et al. 2010, ApJ; Berger et al. 2011, Nature). Quiescent prominences consist of numerous long-lasting, filamentary downflow streams, while transient coronal rain falls along well-defined curved paths. The physical reason for such morphological differences remains unclear. We report a novel, hybrid prominence-coronal rain complex in an arcade-fan geometry observed by IRIS and SDO/AIA, which may provide new insights into this question. The fan region above the arcade hosts a prominence sheet consisting of vertical threads with broad Mg II k/h line widths. As the prominence material descends to the arcade, it turns into coronal rain sliding down coronal loops with line widths 2-3 times narrower. We propose that such different line widths suggest distinct plasma and magnetic conditions. The supra-arcade fan (cf., similar to those in flares; McKenzie 2013, ApJ) is likely situated in a current sheet, where the magnetic field is weak and the plasma-beta could be high, a favorable condition for producing turbulent flows like those filamentary prominence threads. In contrast, the underlying arcade likely has a stronger magnetic field and a low-beta environment, such that the coronal rain is guided along magnetic field lines (e.g., Reale et al. 2013, Science). We will discuss the implication of these novel observations for unifying solar prominence and coronal rain phenomena.