Analysis of the Density Evolution of In-falling Prominence Material from the 7th June 2011 CME

Jack Carlyle*[1], David Williams[1], Lidia Van Driel-Gesztelyi[1], and Davina Innes[2]

[1]University College London - Mullard Space Science Laboratory (UCL-MSSL) – Holmbury St Mary, Dorking, RH5 6NT, United Kingdom

[2]Max Planck Institut für Sonnensystemforschung (MPIS) – Max-Planck-Institut für Sonnensystemforschung Max-Planck-Straße 2 37191 Katlenburg-Lindau, Germany

Abstract

On the 7th June 2011, a large filament suspended over NOAA active region 11226 in the south-west quadrant of the solar disc became unstable and erupted into a complex CME (Bloomfield et al, Astronomy & Astrophysics, November 2012). Some of the filament material then formed cohesive 'blobs' in the corona, many of which fell back to the quiet Sun.
Using the method developed by Williams et al (Astrophysics Journal, March 2013) for determining the column density of such material, we determine the column density and estimate the true density and mass of several of these 'blobs' over the course of their descent to study their evolution.
The method uses two spatially-coherent images of a small square of the surface of the Sun which a blob moves across, the first frame acting as the background measure of emission and the second showing dark material in absorption. The images were collected from Solar Dynamics Observatory's Atmospheric Imaging Assembly (SDO AIA), and the background image was chosen at the time immediately before it became occulted. The absorption is due to the amount of material present and the absorption cross-section of the population, and as such the column density may be estimated directly from the decrease in intensity. This method is applied to five passbands (94, 131, 171, 194 and 211Å), and the results are combined by fitting decrease in intensity as a function of wavelength, giving a stronger determination of column density.
The ultimate aim of this investigation is to analyse the Rayleigh-Taylor instability which the blobs have been shown to undergo by Innes et al (Astronomy and Astrophysics 540, 2012). By obtaining a quantitative assessment of this in-falling material, the physical conditions for such an occurrence will be investigated.

Keywords: prominence, filament, density, eruption, 7 June, Rayleigh, Taylor

*Speaker