

Coronal Mass Ejections Observed at the Total Solar Eclipse on 13 November 2012

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White light observations of the total solar eclipse on 13 November 2012 were made at two sites, where the totality occurred 35 minutes apart. Structure of the corona from the solar limb to a couple of solar radii was observed with a wide dynamic range and a high signal-to-noise ratio [1].

At the east limb, a flare, which was accompanied by a coronal mass ejection (CME), occurred between the two observations of the eclipse, and a CME was observed at the second totality (Figure 1a and the left square in the Figure 1b). The eclipse observation shows both of the CME and related dimming between $1\text{--}2 R_{\odot}$. This fact suggests that the CME material had been located in this height range.

On the other hand, a balloon-like structure at the west limb (Figure 1b, the right square) observed at the eclipse developed to a CME later on, and was observed by SOHO/LASCO (Figure 1d). The balloon-like structure located between $1\text{--}2 R_{\odot}$ is considered to be the source of the CME.

Both the CMEs show that the source region of CMEs was located in this height range, where the material and the magnetic field of CMEs were located before the eruption. This height range includes the gap between the extreme ultraviolet observations of the lower corona and the spaceborne white-light observations of the higher corona, but the eclipse observation shows that this height range is essentially important to study the CME initiation. The eclipse observation is basically just a snapshot of CMEs, but it indicates that future continuous observations of CMEs within this height range are promising.

Reference

- [1] Hanaoka, Y., Nakazawa, J., Ohgoe, O., Sakai, Y., Shiota, K.: 2014, *Solar Phys.*, **289**, 2587.



Figure 1: (a) Image of the white-light corona at 21:14 UT of the 13 November 2012 eclipse. Many raw images were stacked to increase the signal-to-noise ratio, and fine structures of the corona were enhanced. (b) Relative difference of the eclipse corona between 20:39 UT and 21:14 UT. Squares show the CME-related structures. (c) Aligned composite of the CME at the east limb on a SDO/AIA 211 Å image (negative) at the flare maximum (20:53:59) ($< 1 R_{\odot}$), the eclipse corona difference image (21:14–20:39; $1\text{--}2.1 R_{\odot}$), and a SOHO/LASCO relative difference image between 22:11:03 and 20:39:45 ($> 2.1 R_{\odot}$). (d) Aligned picture of the CME at the west limb consisting of an image of the eclipse corona showing the pre-CME loop structure ($< 2.1 R_{\odot}$), and a SOHO/LASCO relative difference image between 20:39:45 (13 November) and 06:23:25 (14 November) ($> 2.1 R_{\odot}$). The solar north is to the top in all the panels.