An SDO/AIA-Observed Filament Eruption Triggered by a Lid-Removal Onset Mechanism

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An AR Ejective Eruption from SDO and STEREO-A

- Active region eruption of 2012 January 23.
- Ejective eruption.
- GOES class M8.7 flare.
- SDO/AIA, various filters (304, 171, 193, 211, 131, 335, 94 Ang.)
- High (adequate!) time cadence (145 s) and high spatial resolution (0''6 pixels).
- SDO/HMI line-of-sight magnetograms.
- On-disk from SDO, limb event from STEREO A.

We will: Overview the full eruption sequence.
Main focus: What is going on in the onset phase?
PFSS Model (Schrijver & DeRosa 2003)
• There are two eruptions (“eruption 1” and “eruption 2”), the latter including the filament. (Both components visible in LASCO CME images.)

• Eruption 1 nearly invisible in cooler on-disk EUV images, but appears as field opening in limb view (STEREO A).

• An even earlier brightening is due to "merging reconnection" (and eruption 1 flare).

• Filament eruption (eruption 2) is due to removal of overlaying flux by eruption 1.

• This "Lid Removal" mechanism is an ideal, non-resistive process. NB., it differs from the breakout mechanism.
What causes Eruption 1 onset?
Conclusions (2012 Jan 23 event)

- Something causes eruption 1; could be flux cancelation from MMFs.
- Eruption 1 field merges with neighboring region, with hot-plasma signature.
- Eruption 1 removes field above filament arcade.
- This leads to destabilization and onset of eruption 2, creating the strongest and hottest GOES flare via Lid Removal.
- Similar processes: E.g. Schrijver & Title (2011), Titov et al. (2012).
- Poster SH13A-2025 (Knox et al.) discussed filament-trajectory shape for this event.