

# **CME Dynamics in Relation to Flare Energetics: First Results**

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## **Aims of this study:** Statistics of

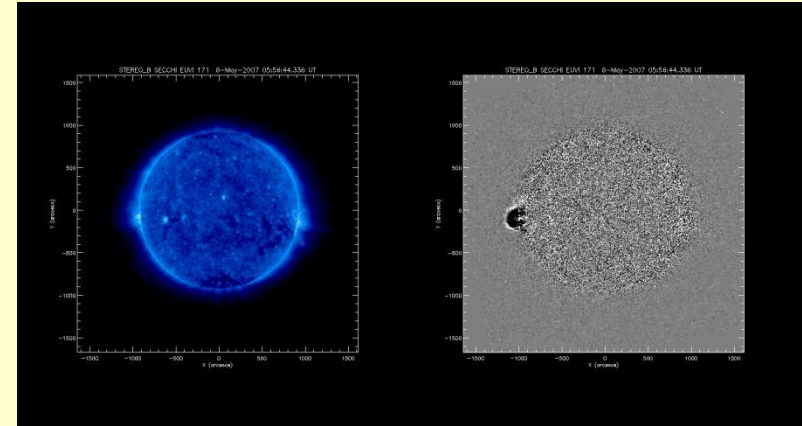
- dynamics of CMEs in the low corona (initiation, impulsive acceleration, propagation)
- CME dynamics in relation to associated flare energetics

## **Former studies:**

- Mainly case studies, e.g. Zhang et al. 2001, 2004, Gallagher et al. 2003, Temmer et al. 2008, 2010; Cheng 2010
- Statistics of ~ 20 events: Maričić et al. 2007, Vršnak et al. 2007

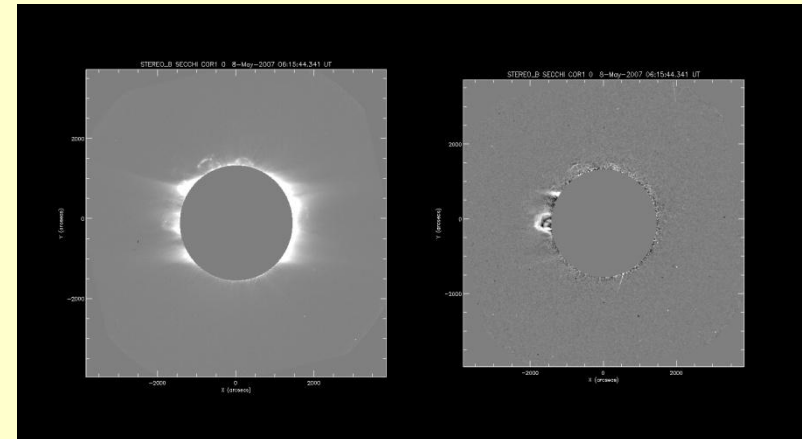
- **CME: STEREO**

- EUVI: 171 Å, 195 Å, 304 Å
- COR1, COR2



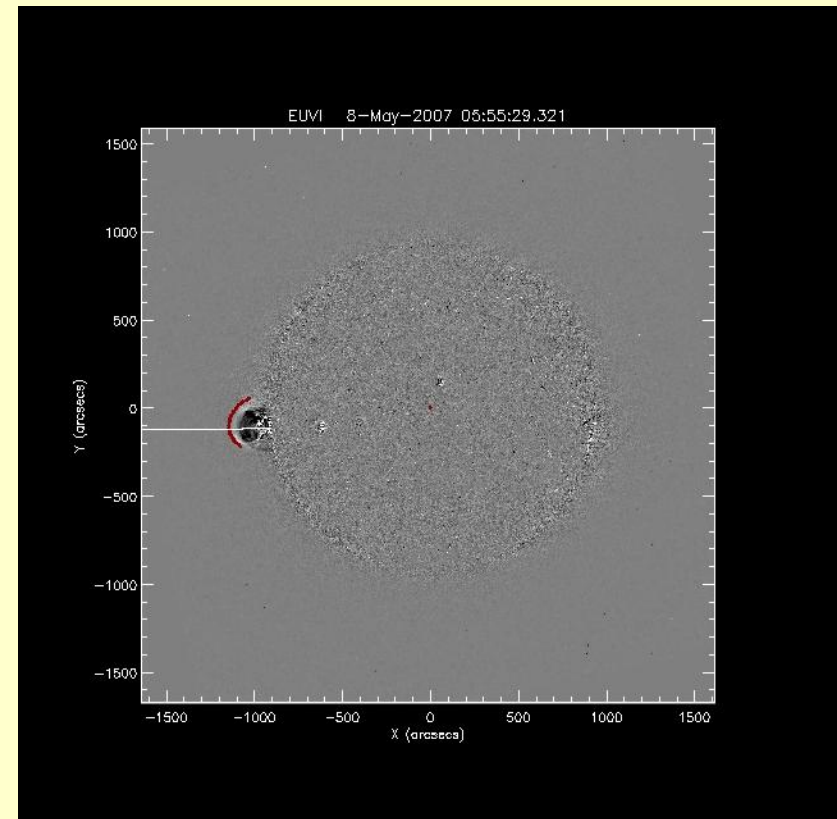
- **Flare: RHESSI, GOES**

- X-ray lightcurves
- Images
- Spectra



- Events during 2007 – 2009
- COR1 CME Catalog and EUVI observations
- Best EUVI/COR CMEs are compared with RHESSEI and GOES flare observations
- About 130 events are selected. Up to now about 40 are evaluated.

- Determination of CME Leading Edge  
(automatically, manual correction)
- Determination of the propagation direction
- Height is averaged over  $10^\circ$  and measured from the CME source region

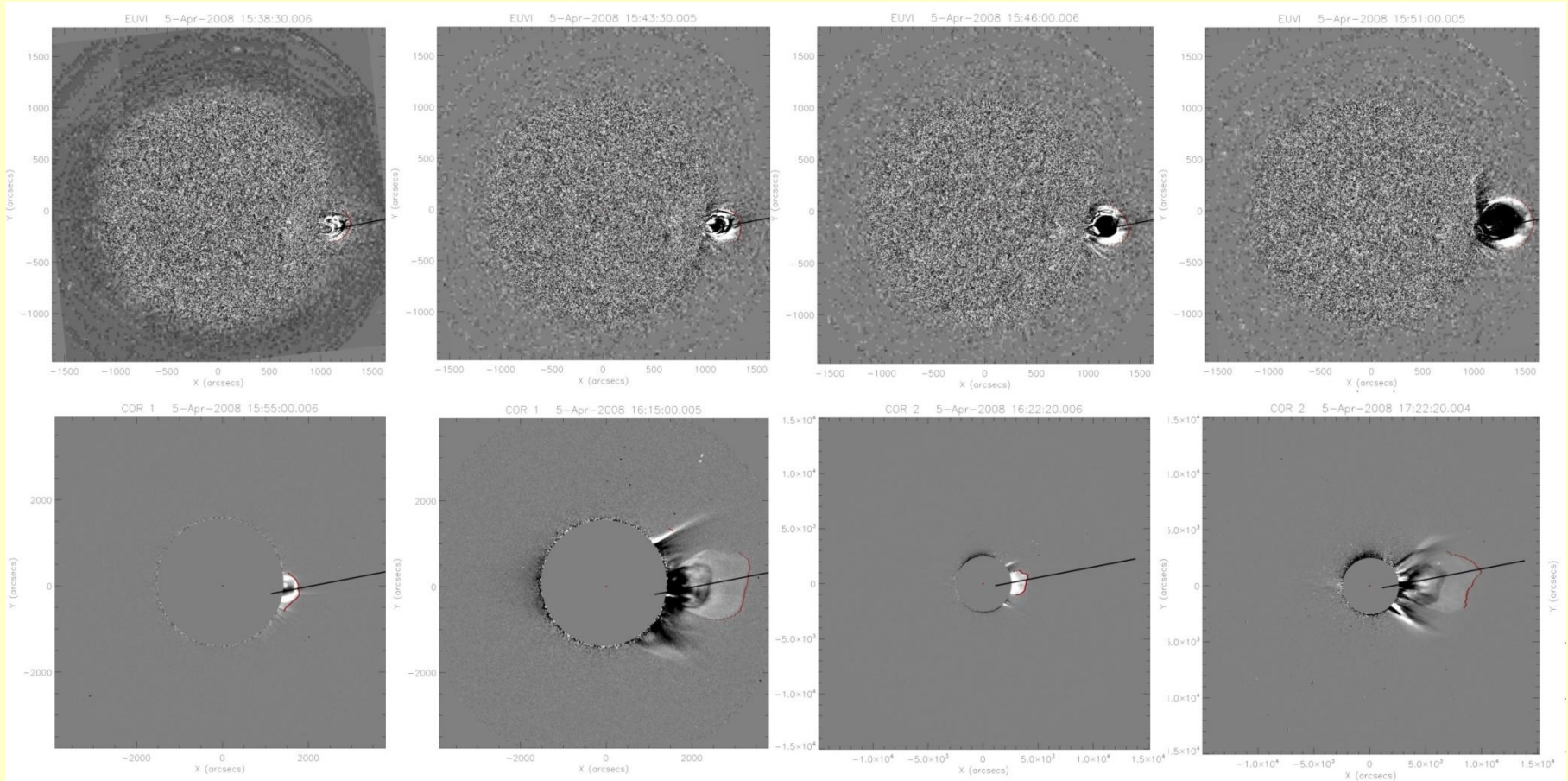


EUVI 171 Å

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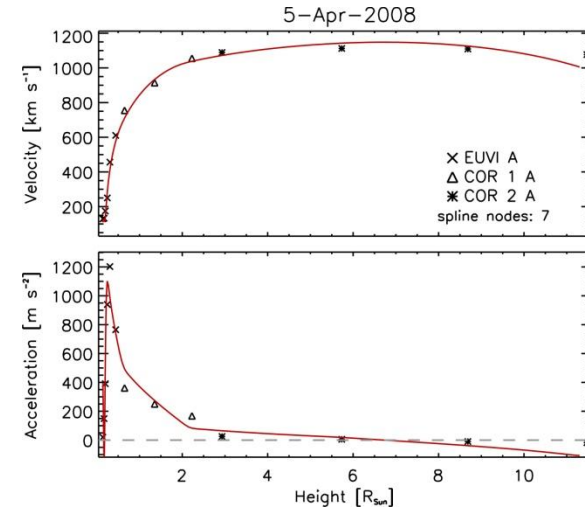
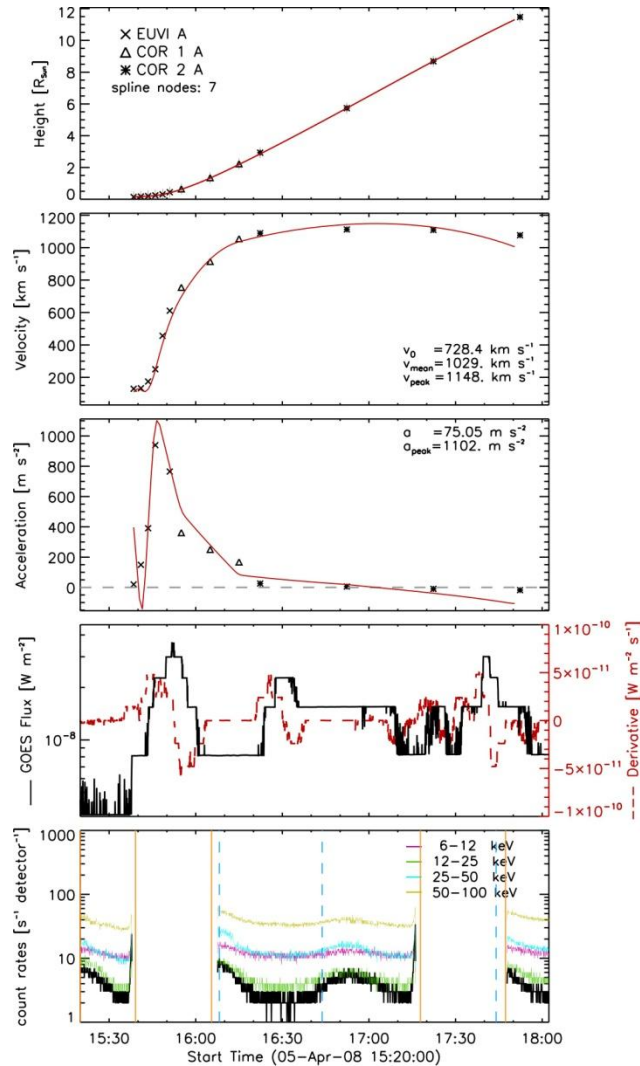
COR 1

COR 1

COR 2

COR 2

[movie](#)

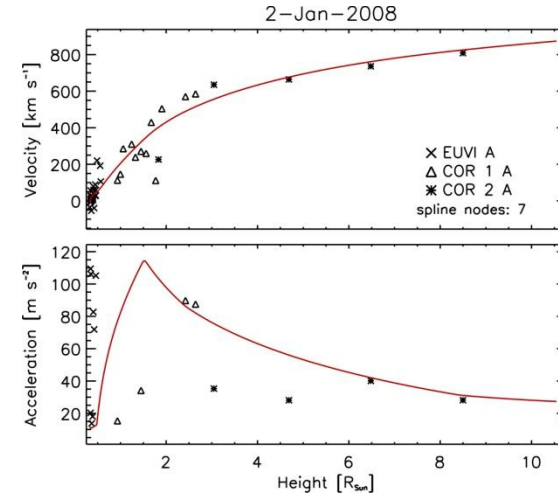
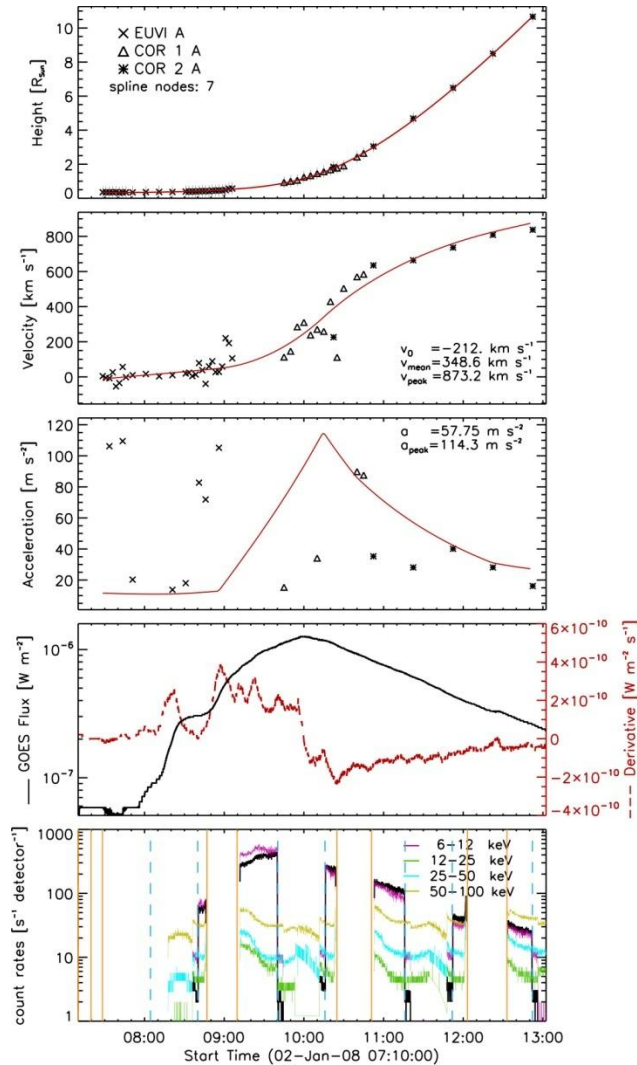


**Figure:**

**Left:** CME height, velocity, acceleration, GOES-Flux and RHESSI observing summary vs. time

**Right:** velocity and acceleration vs. height



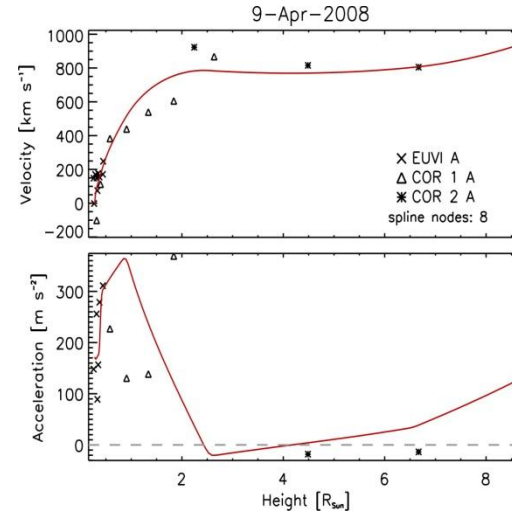
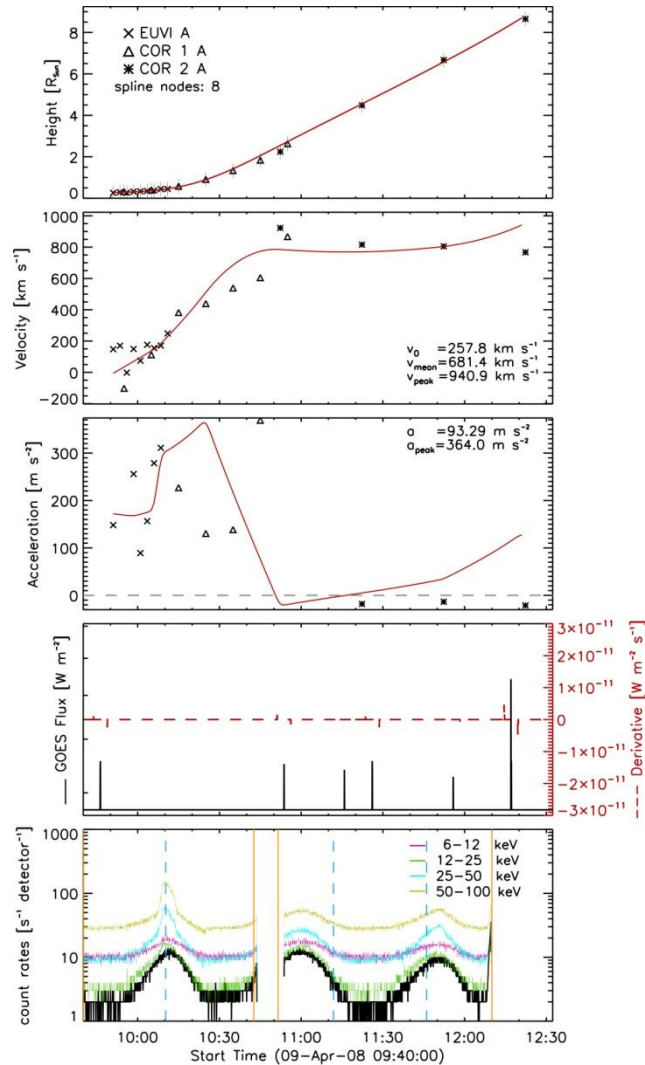


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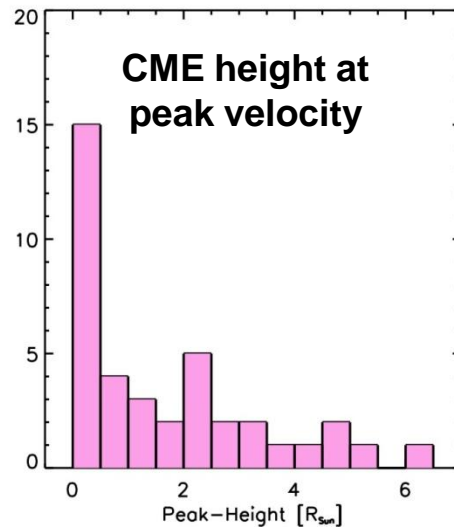
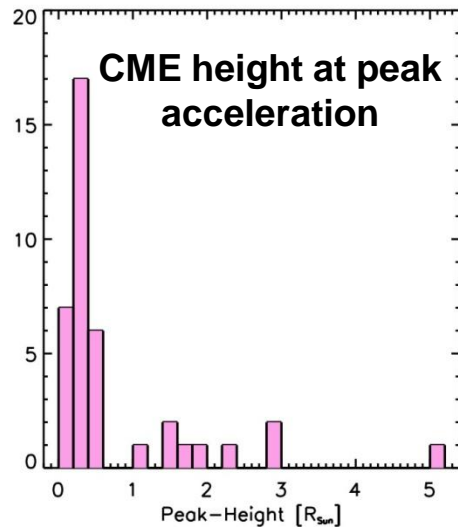
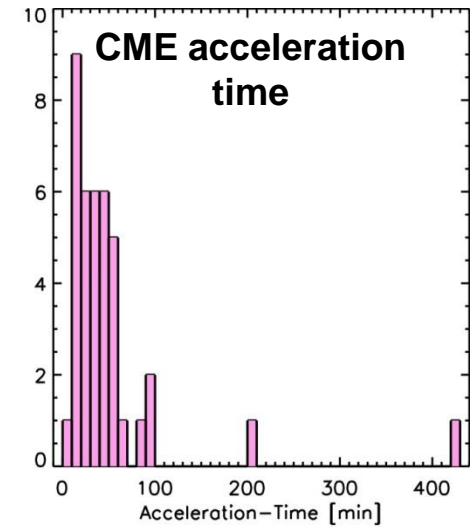
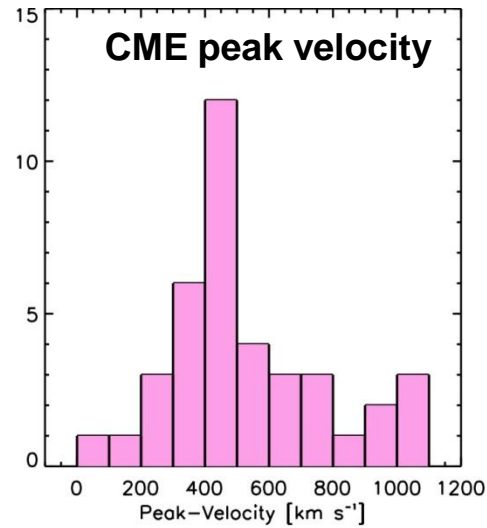
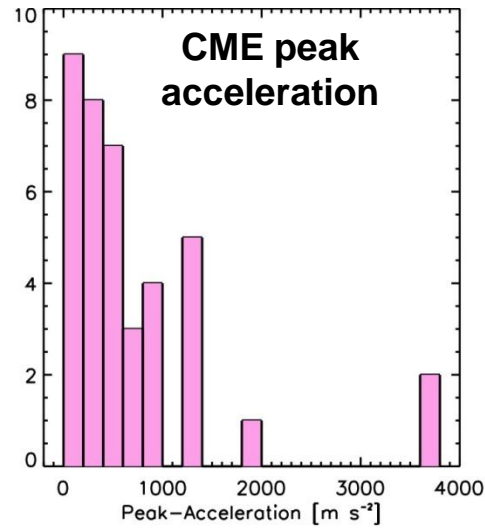


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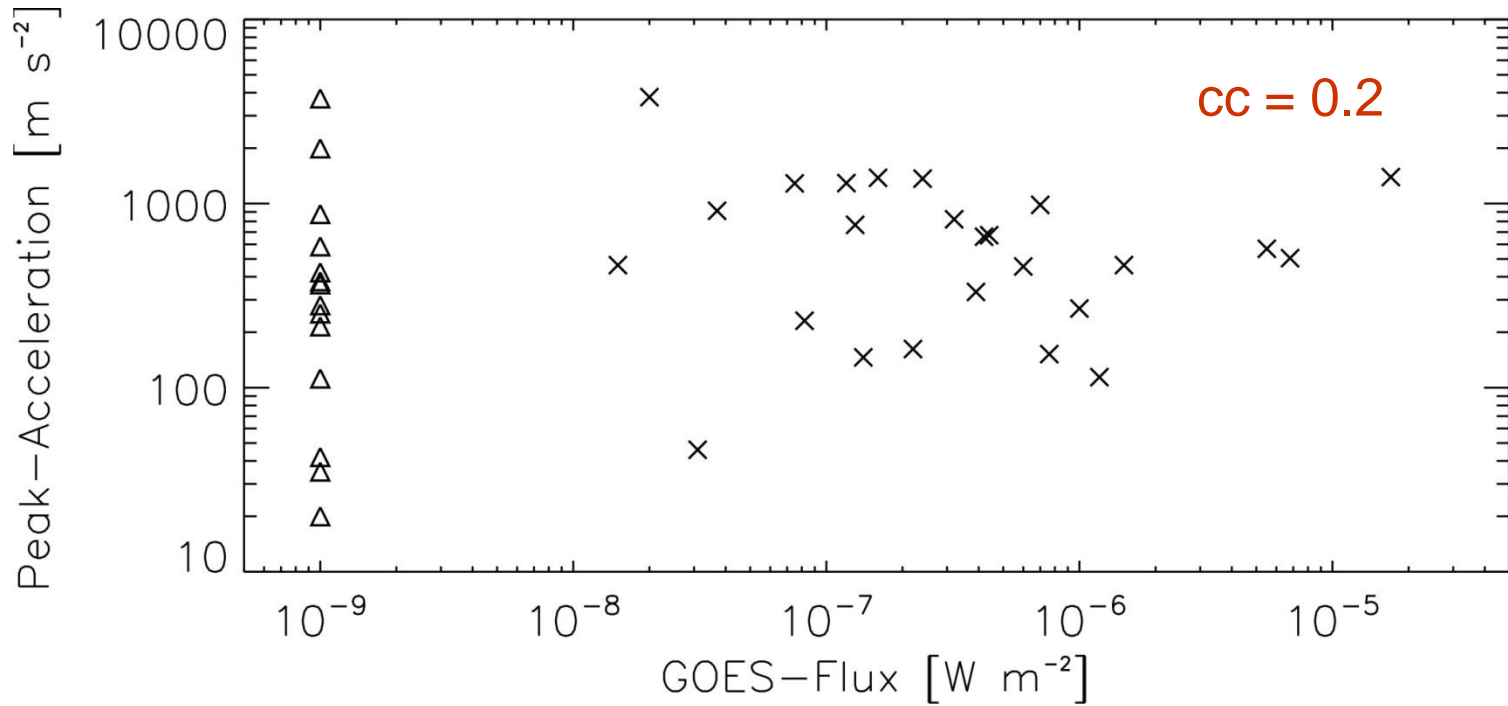
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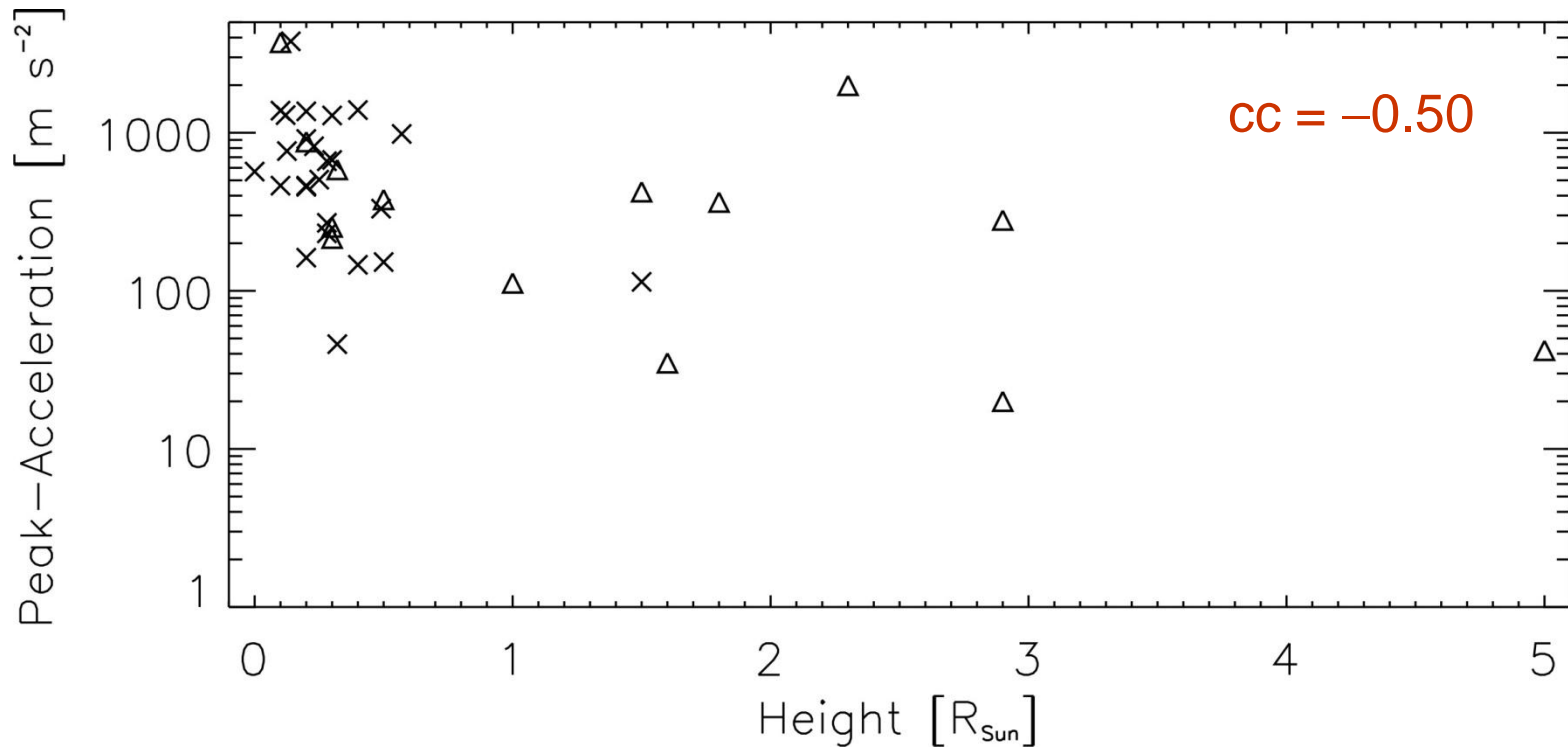
- 25 CMEs with related flare
  - 14 CMEs without flare
- } 39 events
- Determined Parameters
    - maximal acceleration
    - maximal velocity
    - acceleration time
    - height at which acceleration has its maximum
    - height at which velocity has its maximum
    - goes flux



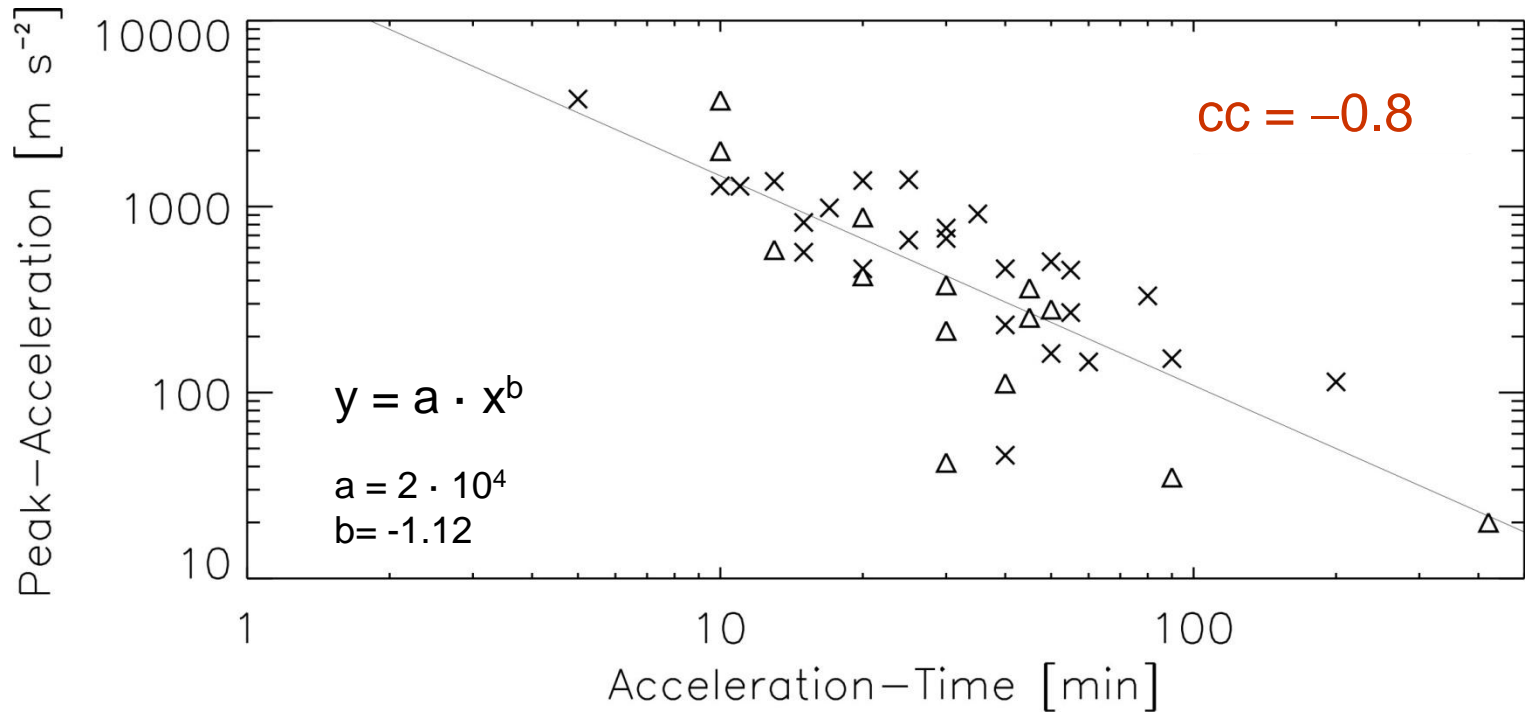
# Peak Acceleration vs. GOES Flux



# Peak Acceleration vs. Height



# Acceleration Time vs. Peak Acceleration





# Discussion and Outlook



## Discussion

- No obvious correlation between flare and CME parameters, probably due to lack of large events (deep solar minimum)
- Negative correlation between CME peak acceleration and CME acceleration time & height
- For most of the events the peak acceleration occurs at  $<0.5R_s$ , i.e. in EUVI FoV and typically not observable in coronagraphs

## Outlook

- Measurement of a larger sample of events (total of 130 selected)
- Inclusion also of CME source region size and width