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Constraining CME Mass in HI-1

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Mass is an important parameter in both the physical processes which govern CME motion and is directly linked to CME observations, as most remote sensing measurements of a CME are white-light images where intensity is correlated with density. As such, mass is both a crucial parameter to measure and one of the few that can be studied directly. Most attempts to determine masses from remote sensing data have focused on coronagraph data, where the CME is bright and still a roughly self-similarly expanding flux rope that has undergone few dynamic changes since the initial eruption. However, to understand the flux rope evolution once the CME begins to interact with the upstream solar wind and determine how it may change in the heliosphere, it is necessary to probe the data and constrain the mass at higher heights. Attempts to extend the coronagraph methods and study the mass at higher heliographic distances have been difficult given the low signal to noise ratio of CME observations in the STEREO SECCHI HI-1 FOV. This study uses improved image processing techniques to better isolate the ejecta mass from the background. Obtaining this signal without resorting to running-difference techniques reduces the amount of useful signal lost due to image processing while still reducing the unwanted contribution from stars and other background features. By comparing the obtained masses with both COR2 measurements as well as in-situ densities we can better understand the challenges in determining mass farther away from the Sun and quantify the systematic error such an approach introduces. Directly studying more local evolution of the mass inside the CME, we can directly address the degree to which the CME evolves non-uniformly and how momentum is transferred between the CME and the upstream solar wind.