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SEP Spectra Estimation from EUV Coronal Shock Imaging

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Recent advances in space-based solar observing have enabled unprecedented access to high-cadence, high-resolution observations of the coronal dynamics. This is extremely important, since transient phenomena in the corona usually cover multiple scales - from the current spatial resolution limit in the case of reconnection, to several solar radii in the case of coronal waves and mass ejections. The latter are also thought to drive shocks in the corona, which in turn have been shown capable of accelerating protons, electrons, and other species up to GeV energies in a matter of tens of minutes. These solar energetic particles (SEPs) are a prime source of space weather. Historically, it has been notoriously difficult to extract information about energetic particle spectra in the corona, due to the lack of in situ measurements. It is possible, however, to use remote observations in order to deduce coronal shock dynamics and related particle spectra. We present an effort to estimate coronal SEP spectra in real events based on a combination of fast-cadence extreme ultraviolet imaging (from the SDO/AIA instrument), potential coronal magnetic field models, and time-dependent modeling of diffusive shock acceleration. The ultimate goal for this framework is to give predictions for the possible locations of radio type II bursts during a coronal shock, as well as SEP spectra. It is designed in a modular fashion, and may be adapted for near real time use. This system can be applied to predicting the severity of SEP events with larger lead times.