Solar Flare Observations and Model Predictions for the Next Solar Magnetic Activity Maximum

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Abstract

Sunspot Cycle 25 has begun, and predictions for the severity of space weather range from one of the weakest maxima on record to a very strong one. Solar flares are one such manifestation of magnetic activity and space weather that will increase in regularity. We are continuing to learn much about the physics of solar flares that occurred in Cycle 24, due in large part to near- and far-UV spectra from Interface Region Imaging Spectrograph (IRIS). Of particular importance are the magnificent high-cadence observations of the broadening and asymmetries of chromospheric emission lines in IRIS spectra of flares. Over the next cycle maximum, the National Science Foundation's Daniel K. Inouye Solar Telescope (DKIST) will provide solar flare optical and near-infrared spectra at the highest-ever spatial, temporal, and spectral resolution. Consequently, there will be a renewed interest in the diagnostic potential of the hydrogen Balmer and Paschen series in solar flares, especially from regions where large fluxes of accelerated particles impinge on the lower atmosphere. In this talk, I will discuss new time-dependent model predictions of hydrogen line broadening in optical spectra of solar flares. I will show how the unique observational capabilities of the DKIST can be leveraged to test these models while also providing much-needed constraints for the interpretation of stellar flare spectra.