CHARACTERIZING THE COMPLEX MORPHOLOGY OF FLARES ON GKM DWARFS

Suzanne Hawley
University of Washington
GO30002

Active G, K, and M dwarfs exhibit energetic outbursts caused by magnetic reconnection events, called flares, which occur over a large range of timescales and energies. While analysis of high cadence observations has shown that canonical (fast rise, exponential decay) flares can be represented by a T = 8,000 to 10,000 K blackbody component (Hawley & Fisher 1992, Hawley et al 2003), flares which exhibit highly complex light curves (characterized by > 15 additional sub-events) have been phenomenologically modeled as T = 16,000 to 20,000 K hotspots near the photosphere (Kowalski et al 2010b). Such hotspots require about 14x more heating of the photosphere than predicted by current radiative hydrodynamic (RHD) models, potentially indicating a new, significant gap in our understanding of flare physics. We propose to monitor 2 active G, 1 active K, and 3 active M dwarfs at short (1 minute) cadence for 6 months. These data will enable us to (a) determine when and how often light curve substructure forms during flares, as a function of total flare energy; and (b) ascertain whether the prevalence of this complex morphological structure changes with spectral type (G to K to M) and across the convective boundary in M dwarfs. This program will provide the first statistical assessment of whether flare-induced hotspots are a common byproduct of flares and whether there is a threshold flare energy required to trigger the phenomenon, hence constraining efforts to develop self-consistent models that accurately describe the physics of stellar flares.