Exploring flares around the ultracool M dwarf VB-10 with high resolution infrared spectroscopy

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https://shbhuk.github.io/

- The Habitable-zone Planet Finder (HPF) is a near-infrared (810-1280 nm) stabilized precise radial velocity spectrograph located at the Hobby Eberly Telescope in Texas, USA.
- As part of its Guaranteed Time for Observations (GTO) RV survey, HPF has been observing VB-10, an M8 M dwarf for about 2.5 years.
- Over these visits, we find two flares in the spectra, one of which we discuss here (JD 2458715).
- High resolution spectroscopic data for flares around such ultracool stars is extremely rare, and even more-so in the near-infrared.

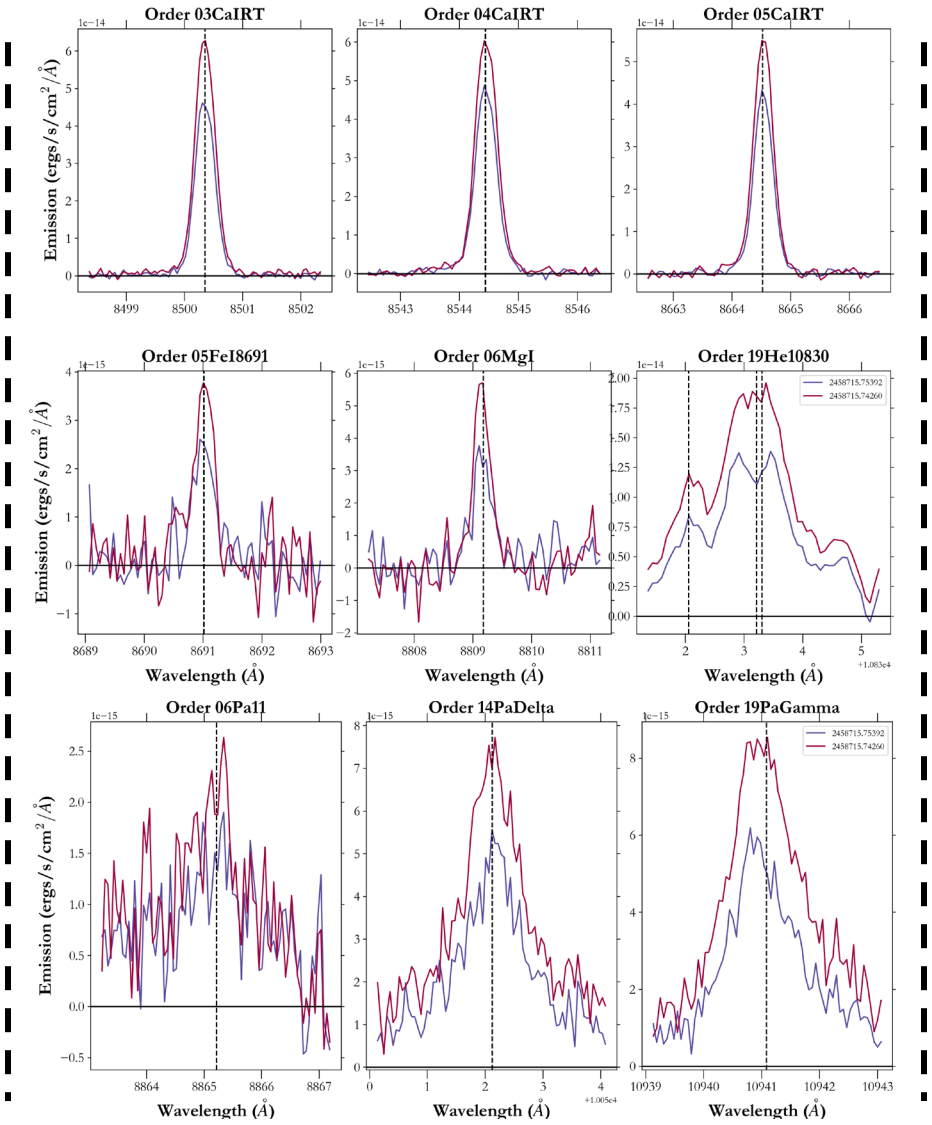

Figure 1: Showing the quiescent-subtracted emission spectra during the flare for VB-10, where the 2 colours are the 2x sequential 15-minute observations from HPF.

Flare	JD x715.743	JD x715.754
CN Leo – M6.5 (Fuhrmeister et al. 2018)	10.6	14.7
2M1028 – M7 (Schmidt et al. 2007)	68.7	95.4
2M0149 I – M9.5 (Liebert et al. 1999)	2.4	3.3
2M0149 II – M9.5 (Liebert et al. 1999)	2.5	3.5
2M0149 III – M9.5 (Liebert et al. 1999)	2.1	2.9
2M0149 IV – M9.5 (Liebert et al. 1999)	1.6	2.2

Ratio of Ca 8542 A line seen in other flares, to the VB-10 flare

- The Ca infrared triplet lines are similar in strength, signifying that the flare was optically thick during this epoch.
- Our spectra also includes a few Paschen lines in emission. We are currently trying to extrapolate the Pa line fluxes, to estimate the H alpha equivalent width, and subsequently compare this flare with other visible light observations of M dwarf flares.
- These observations of VB-10 add to the spare literature present of high resolution near-infrared spectra of late M dwarf flares.

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