Infrared Flares on M Dwarfs: a Hinderance to Future Transiting Exoplanet Studies

James. R. A. Davenport[1, 2, *]

[1]*Department of Physics & Astronomy, Western Washington University, 516 High St., Bellingham, WA 98225, USA*
[2]*Department of Astronomy, University of Washington, Seattle, WA 98195, USA*

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many current and future missions are pushing to infrared (IR) wavelengths to study exoplanets. the motivation for this includes both studies of features in planetary atmospheres where the flux contrast between the planet and star is more favorable (Deming et al. 2009), and the decreased impact of stellar activity. Indeed, recent analysis of stellar activity, specifically starspots and faculae, found to not substantially impact the transit signatures from FGKM stars with JWST (Zellem et al. 2017). However, this is not true in the case of flares. flares have already been a roadblock for detecting transits for stars in the optical (e.g. Proxima b Davenport et al. 2016; Kipping et al. 2017).

Dedicated observations by Tofflemire et al. (2012) put upper limits on flare flux in the IR for mid-M dwarfs from for moderate amplitude events. Davenport et al. (2012) created peak-flux conversions between $ugrizJHK$-bands for M0–M6, which imply very small amplitudes for IR compared to the dramatic events in the optical.

infrared flares have been observed now, most notably in the transit observations of TRAPPIST-1. This system is an M8, hosting 7 transiting exoplanets discovered by ground- and space-based monitoring (Gillon et al. 2016, 2017) follow-up data from *Kepler*/K2 able to find period of outer planet (Luger et al. 2017) and recovered many flares for this active low-mass star (Vida et al. 2017). BOTH the IR and the Optical data contain flares that partially overlap transits: TRAPPIST-1b in the IR from Gillon et al. (2017) and TRAPPIST-1h in the optical from Luger et al. (2017). Figure 1 shows examples, plus the typical figure of merit for flare occurrence, showing powerlaw behavior in both the optical and IR, and with comparable occurrence frequency.

Since flares are common for low-mass stars, and can occur even for "inactive" stars (e.g. Hawley et al. 2014), we suggest that future surveys include optical monitoring during transits to help calibrate out the effects of flares. Because flares are significantly higher amplitude in the optical, this monitoring need not be to the same photometric precision, and can likely be done from the ground.

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Corresponding author: James. R. A. Davenport
jrad@uw.edu

* NSF Astronomy and Astrophysics Postdoctoral Fellow
DIRAC Fellow

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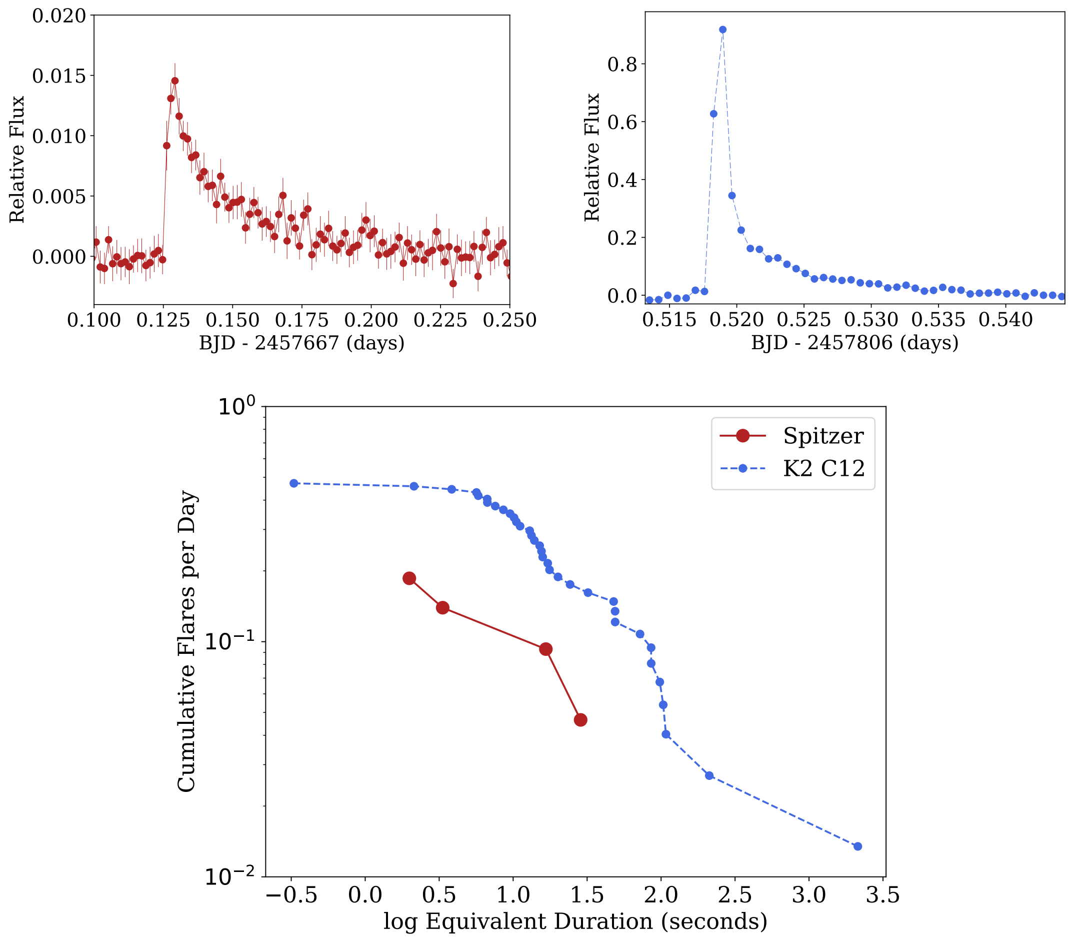

Figure 1. Top: Flares from Spitzer (left) and K2 (right) on TRAPPIST-1. Bottom: Cumulative flare frequency distributions for both Spitzer and K2 flare events in units of Equivalent Duration, which can be converted to event energies by

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