How well do we know the impact of stellar flares on exoplanets?

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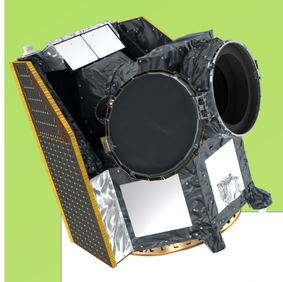
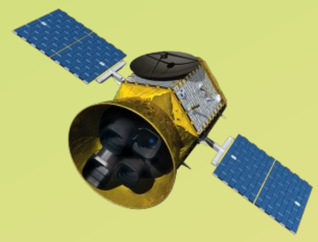
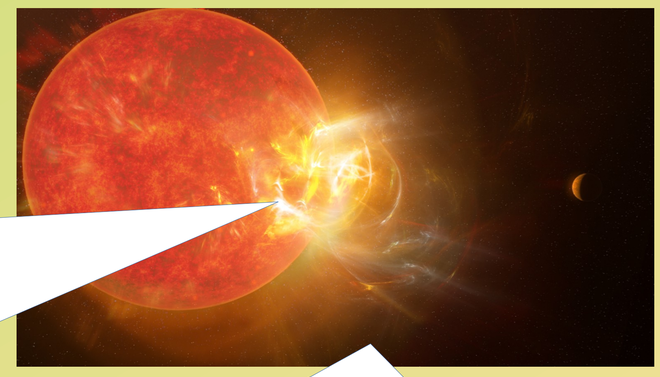


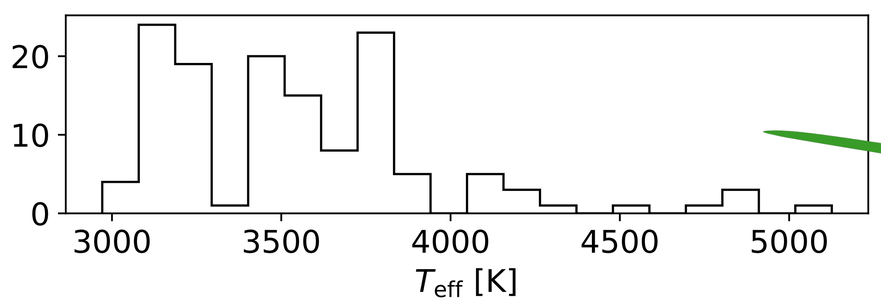


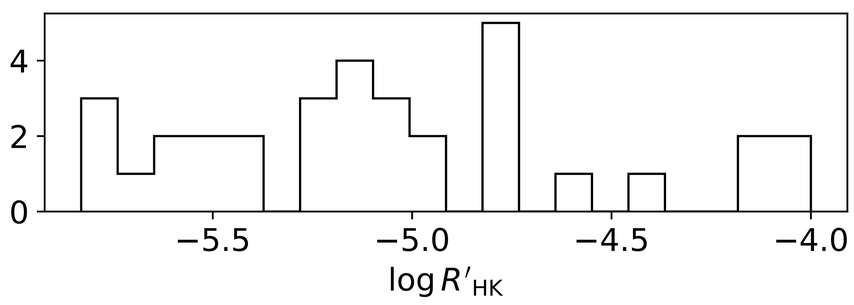
To understand magnetic reconnection in stars, as well as planet atmospheres and habitability (particularly around cool, active hosts), we need to study stellar flares.
As part of the CHEOPS GTO program, we used the **highest time cadence the CHEOPS and TESS** space telescopes are capable of to probe **white-light flare detailed morphologies** in a sample of 130 late K and M stars.



Credit: S. Dagnello, NRAO/AUI/NSF

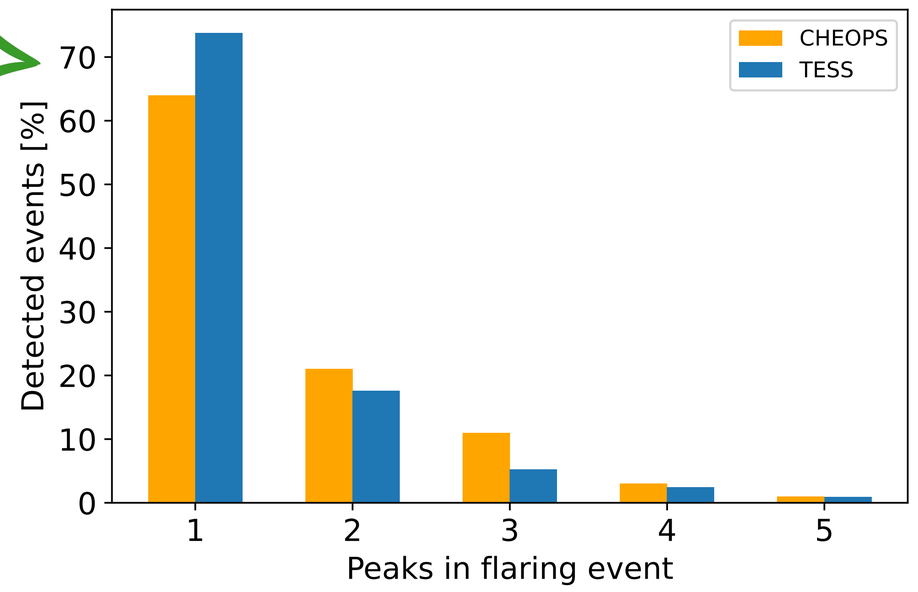
Selected sample (7-11.5 Gaia G mag)





The sample includes low-activity level stars coming from exoplanet radial-velocity search catalogues but not only, and in particular stars for which “pre-flare dips” were observed (e.g. Ventura et al. 1995).

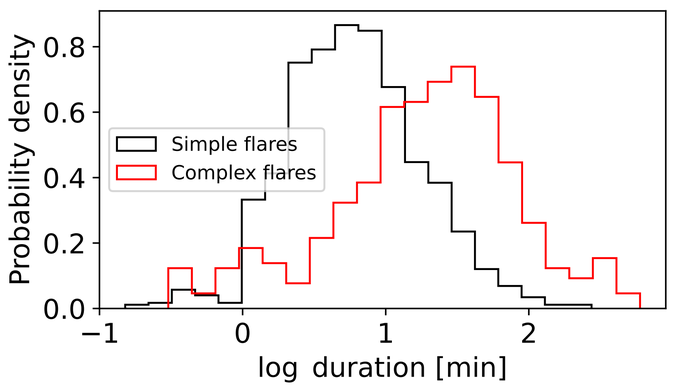
Part of the code we developed is being adapted to be integrated into the PLATO data pipeline. You can find it at https://github.com/giovbruno/flarefinder.

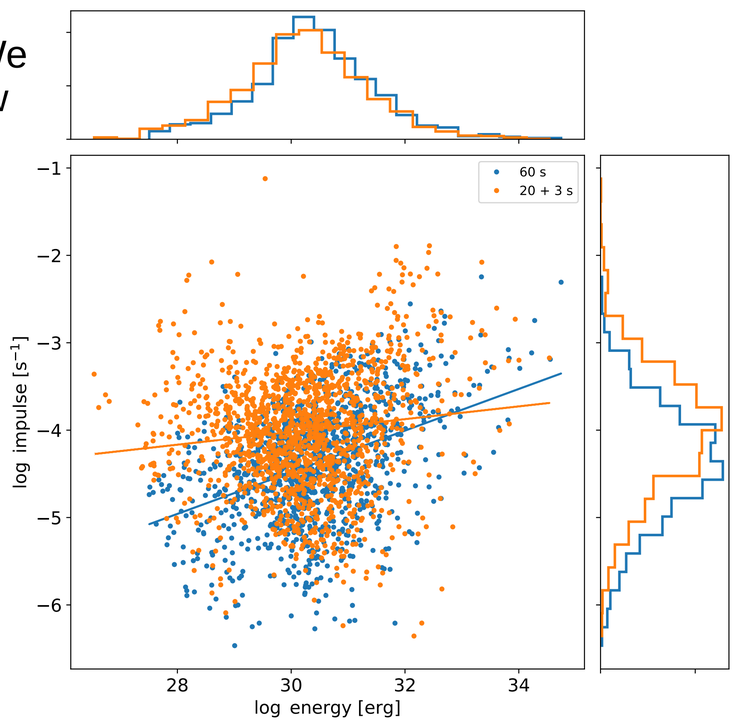


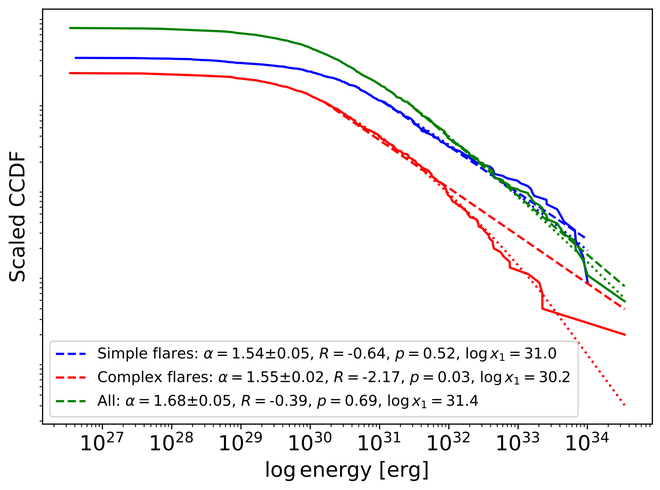
Both CHEOPS and TESS data indicate a > 30% percentage of multi-peak flares (over about 1400 total).

Results

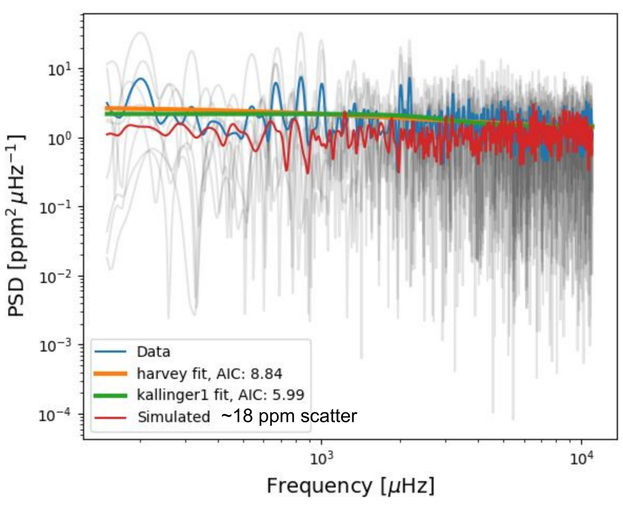
We derived flare parameter statistics and separated single- and multi-peak events. We also aimed to quantify the advantage of few seconds with respect to a minute data cadence to probe the details of flare profiles.







Following solar flare studies, we compared power law descriptions of the flare parameter distributions with log-normal distributions, which might provide alternative indications about flare formation.



Work in progress

Stellar granulation has never been detected in M stars. We are using the CHEOPS light curves of our brightest targets in an attempt to reveal it.

Curious to know more?
Bruno et al. (2024), in press on A&A
- You can find me on the conference app or at giovanni.bruno@inaf.it.

References Ventura et al. (1995), A&A, v.303, p.509; Verbeeck et al. (2019), ApJ 884, 1
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