Giant white-light flares on fully convective stars occur at high latitudes

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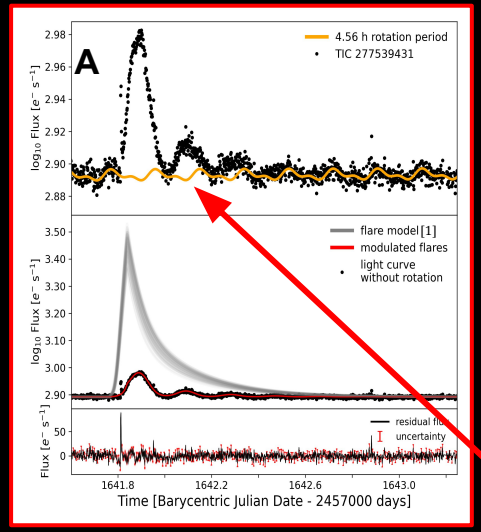
In a systematic analysis of late M dwarfs observed with TESS, we detected four stars with giant flares that were modulated in brightness by the stars' rapid rotation. Using the shape of the modulated curve we could localize these flares **between 55° and 81° latitude on the stellar surface,** far higher than typical solar flare latitudes.

These results suggest:

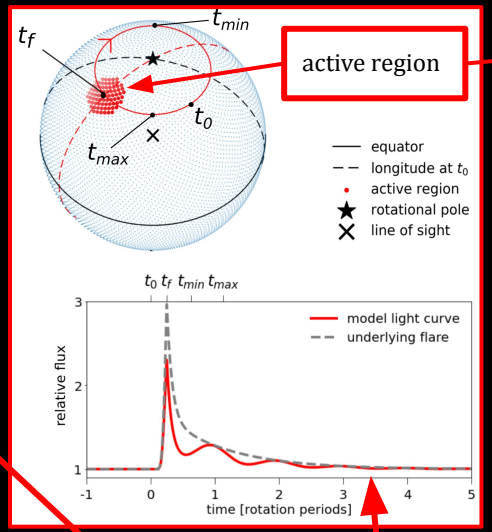
a. Strong magnetic fields tend to emerge close to the stellar rotational poles in rapidly rotating fully convective stars.

b. The impact of flares on the habitability of exoplanets around small stars could be weaker than previously thought.

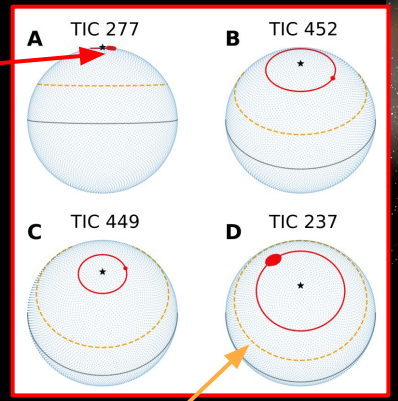
1. data :: TESS light curves



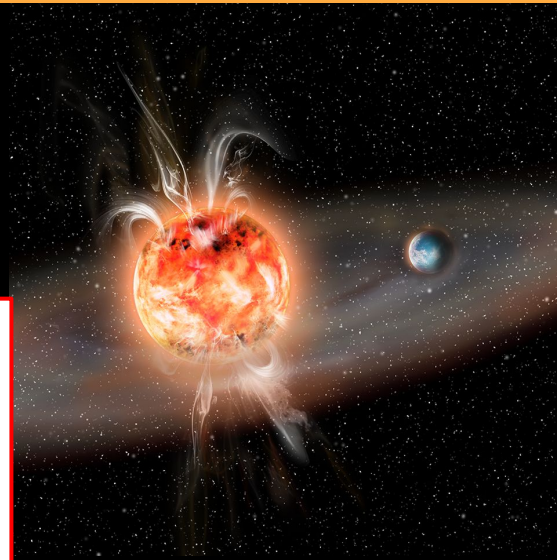
2. model :: rotational modulation



3. results :: high latitudes



typical max. solar flare latitude



→ XUV emission from flares is optically thin, and its impact on the exoplanetary atmospheres will remain largely unaffected by the flare's latitude. Energetic particles associated with large flare events, however, will be ejected radially outwards near the poles, sparing planets orbiting in the equatorial plane.

	A	B	C	D
spectral type	M7	M7	M6	M5
flare latitude [deg]	**80.9 ± 0.5**	**63.1 ± 3.6**	**71.9 ± 1.1**	**55.2 ± 5.5**
rotation period [h]	4.56	4.22	2.71	8.43
log(flare energy) [erg]	34.5	33.5	33.4	34.6

The flare flux is modulated while the active flaring region (partially) moves in and out of view on the stellar surface.

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[1] Davenport et al. (2014), ApJ, 797, 122