

Stellar superflares in NGTS

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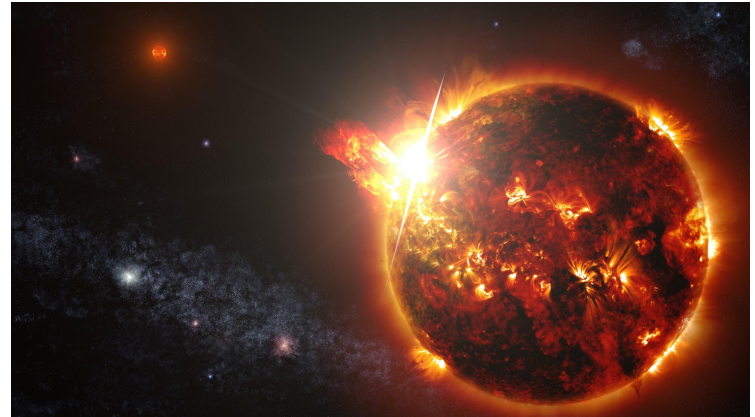
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Stellar flares

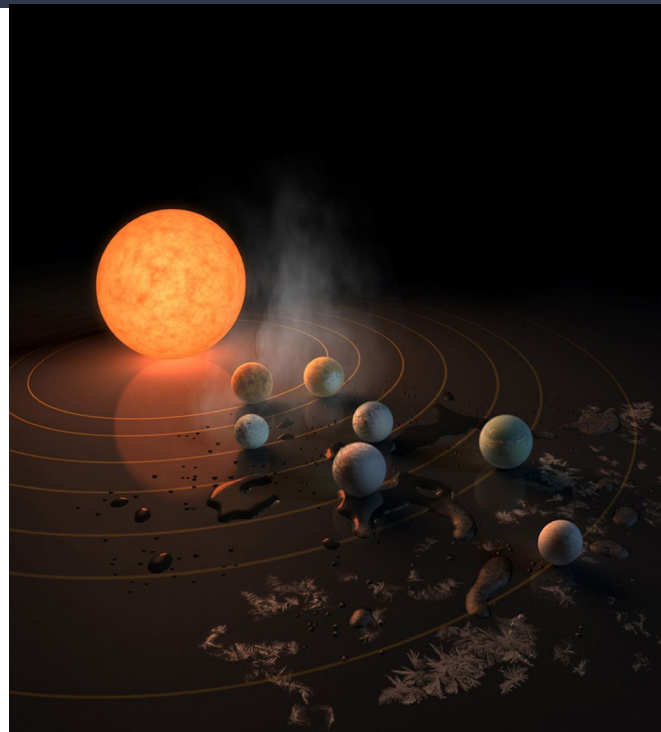
- Explosive phenomena caused by reconnection events in the magnetic field of a star
- Typically at least 100 times greater in energy than the Carrington solar event, but can go up to 10,000 times

Image credit:
NASA's Goddard
Space Flight
Center/S.
Wiessinger



Effects on habitability

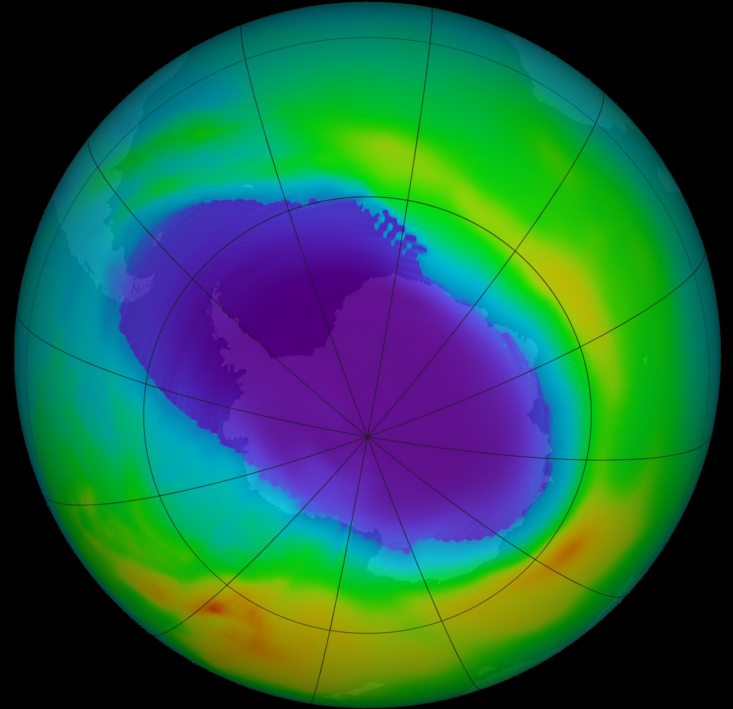
- Stellar flares could have a big impact on the habitability of exoplanets
- In particular on “habitable zone” Earth sized planets around M Dwarfs - e.g. TRAPPIST-1
- Superflares can cause...



Effects on habitability

- Ozone Depletion
- Increased UV irradiation
- Atmospheric Removal

Image credit: NASA/Goddard
Space Flight Center Scientific
Visualization Studio



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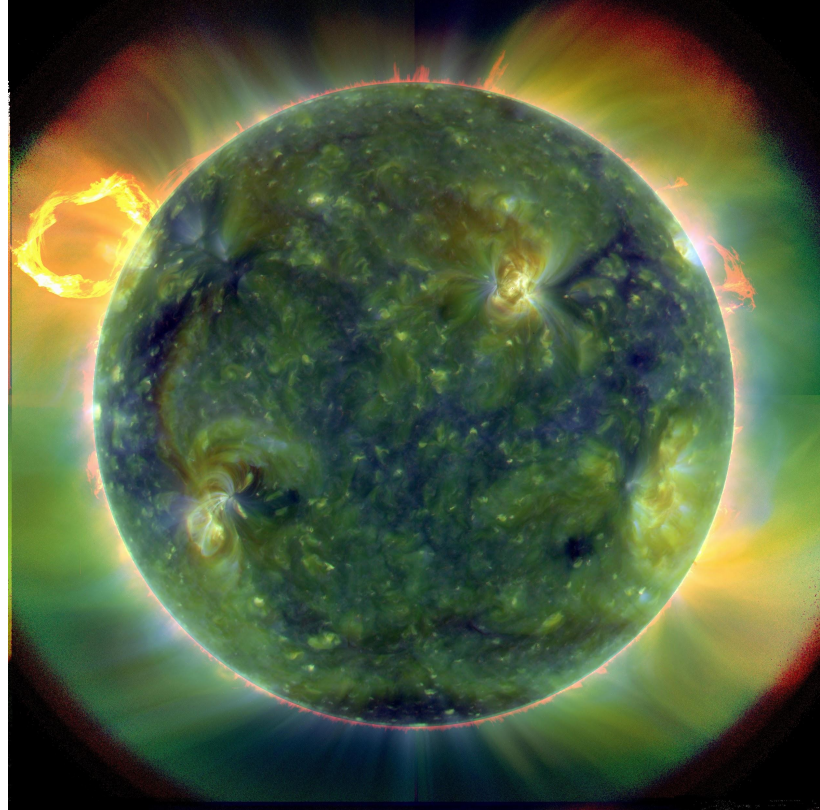
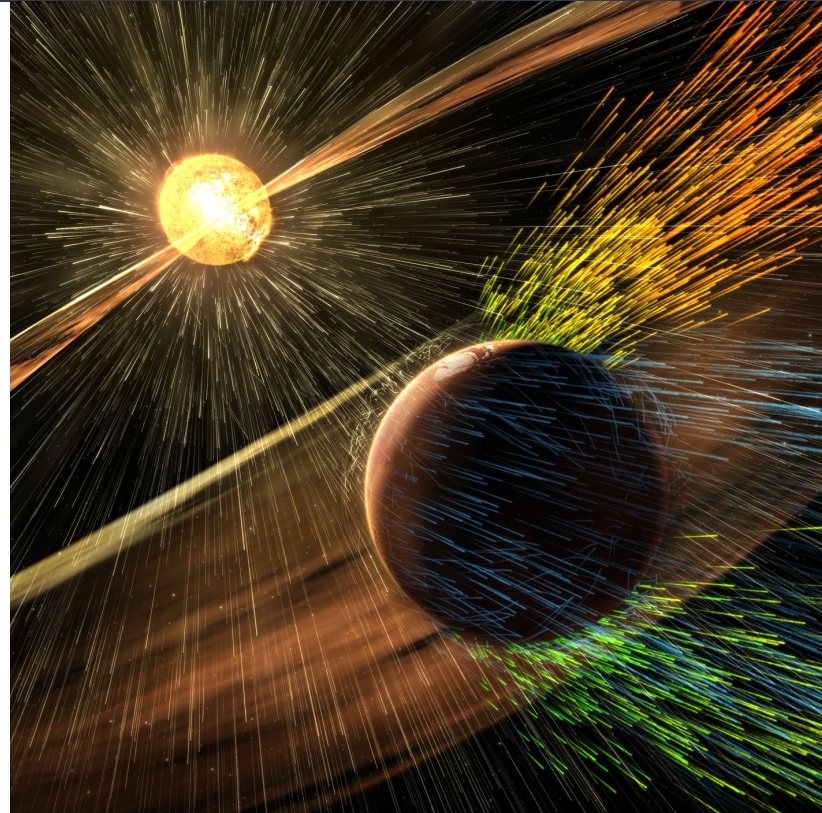


Image credit: NASA/ SDO

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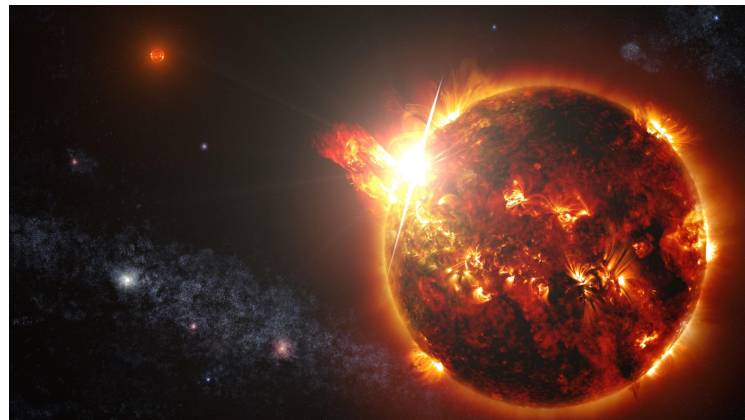
Image credit: NASA's
Scientific Visualization
Studio and the MAVEN
Science Team



Stellar flares

- Need to understand how often they occur, range of energies, amplitudes, durations...
- Especially for G-M spectral types
- Single events difficult/ impossible to predict

Image credit:
NASA's Goddard
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Wiessinger



Kepler and K2 Results

- Studies of G star superflares
- Stellar flare morphology
- Long baseline photometry - occurrence rates for spectral types and single stars

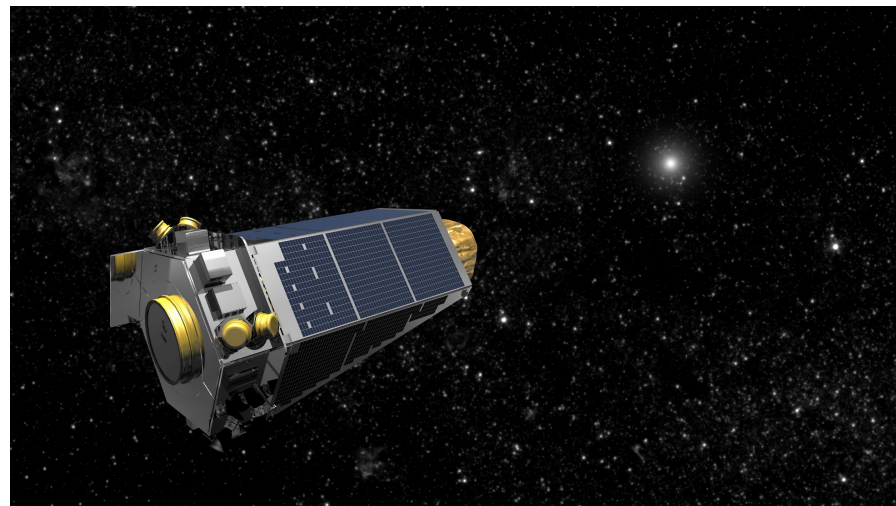


Image credit: NASA

Kepler and K2 Results

- Studies of G star superflares
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BUT

- Vast majority of observations at 30 minute cadence - miss short events!
- Set target list
- Real-time follow up not possible



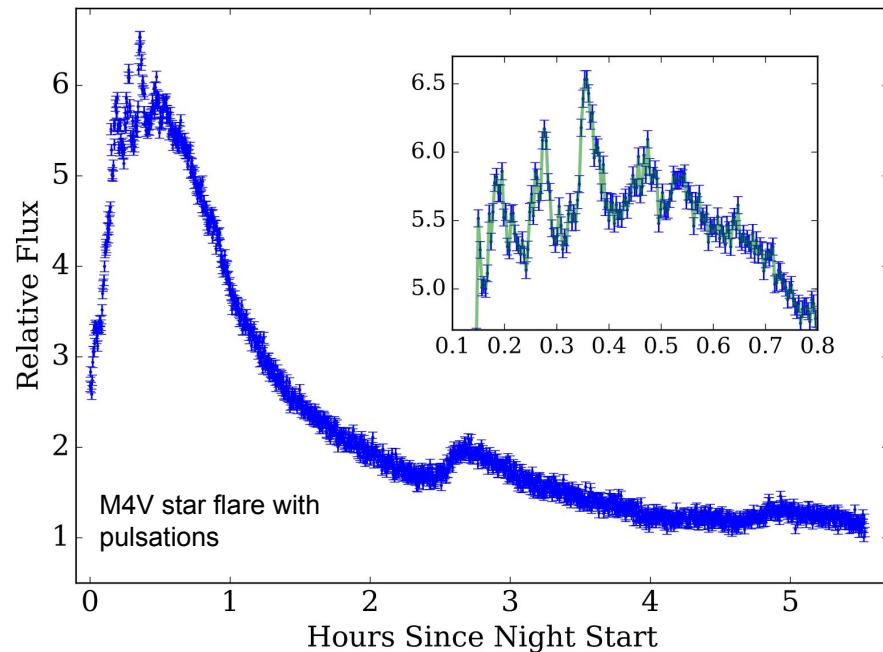
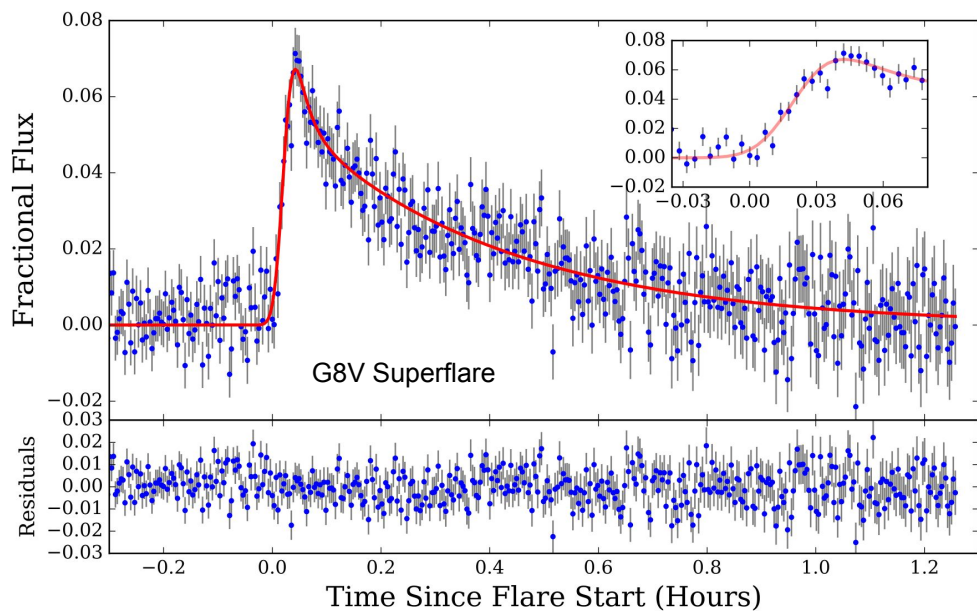
Image credit: NASA

NGTS



Image Credit:
ESO/ G.Lambert

Superflares in NGTS

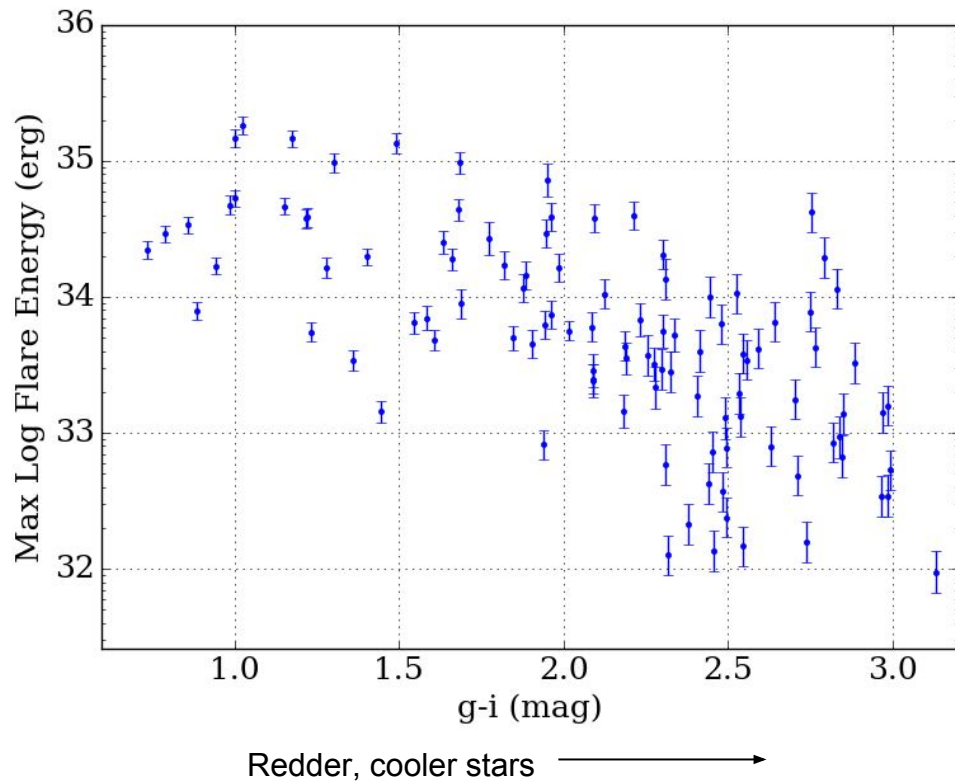


Flare brightness ≥ 5.5 stellar brightness!

- Spectral types G8V to M5V

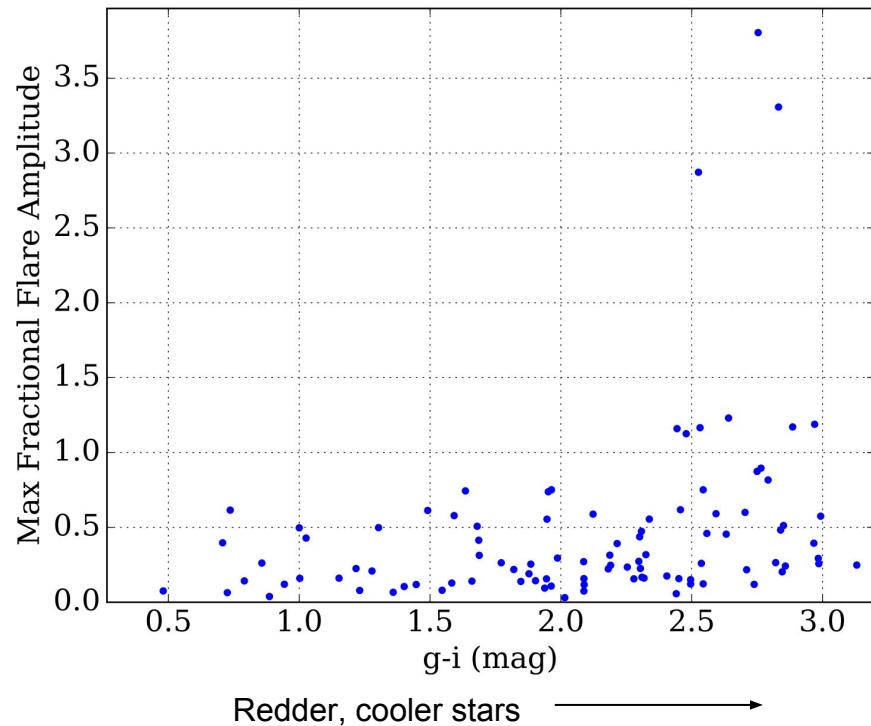
Flare Statistics – Energy

- Push redder than previous *Kepler* data
- Upper envelope of flare energies



Flare Statistics – Fractional Amplitude

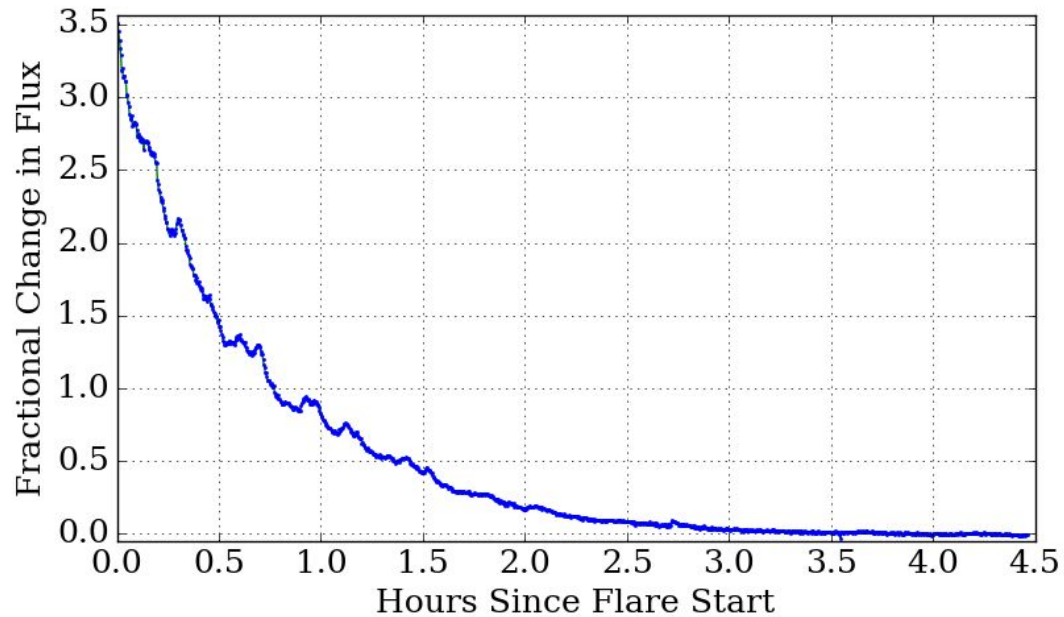
- Increase in brightness against stellar colour
- Sudden increases in flux could act to move the “habitable zone” outwards for short periods of time



1.0 = Flux increase due to flare equal to quiescent flux of star

Single Stars

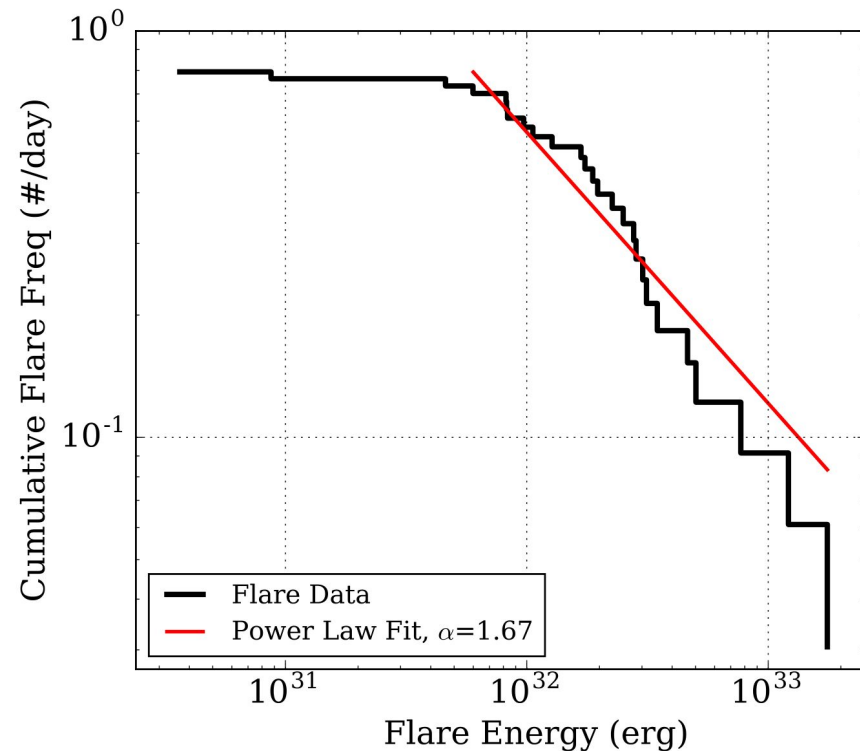
HD43162C



- Active M3.5 dwarf

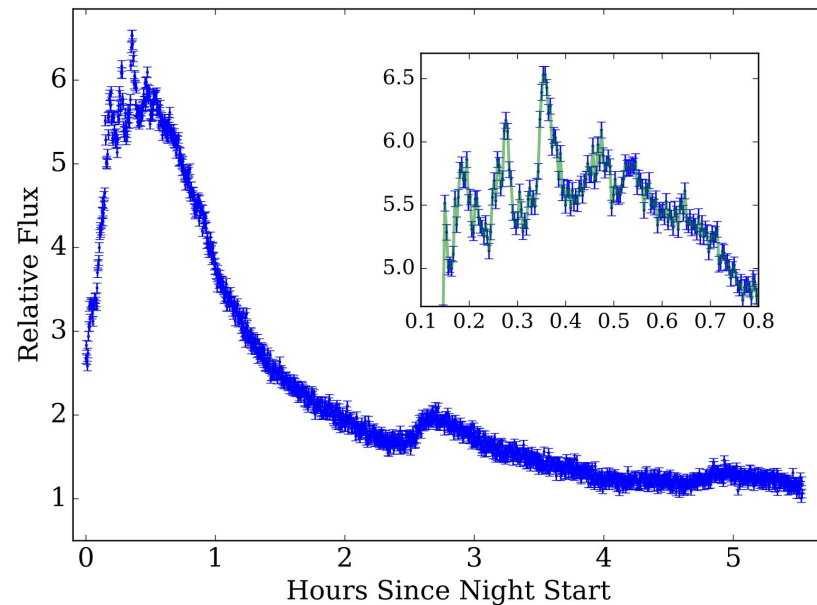
HD43162C – Flaring Activity

- Flaring rate - how many flares above a certain energy we'd expect per day
- Result could be put into studies of flaring activity on planetary atmospheres



Conclusions

- Studies of stellar flares need to be done to fully understand occurrence rates and energies
- NGTS is well suited for both surveys and single star studies
- First year of NGTS data will soon be made public, available on the ESO archive



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