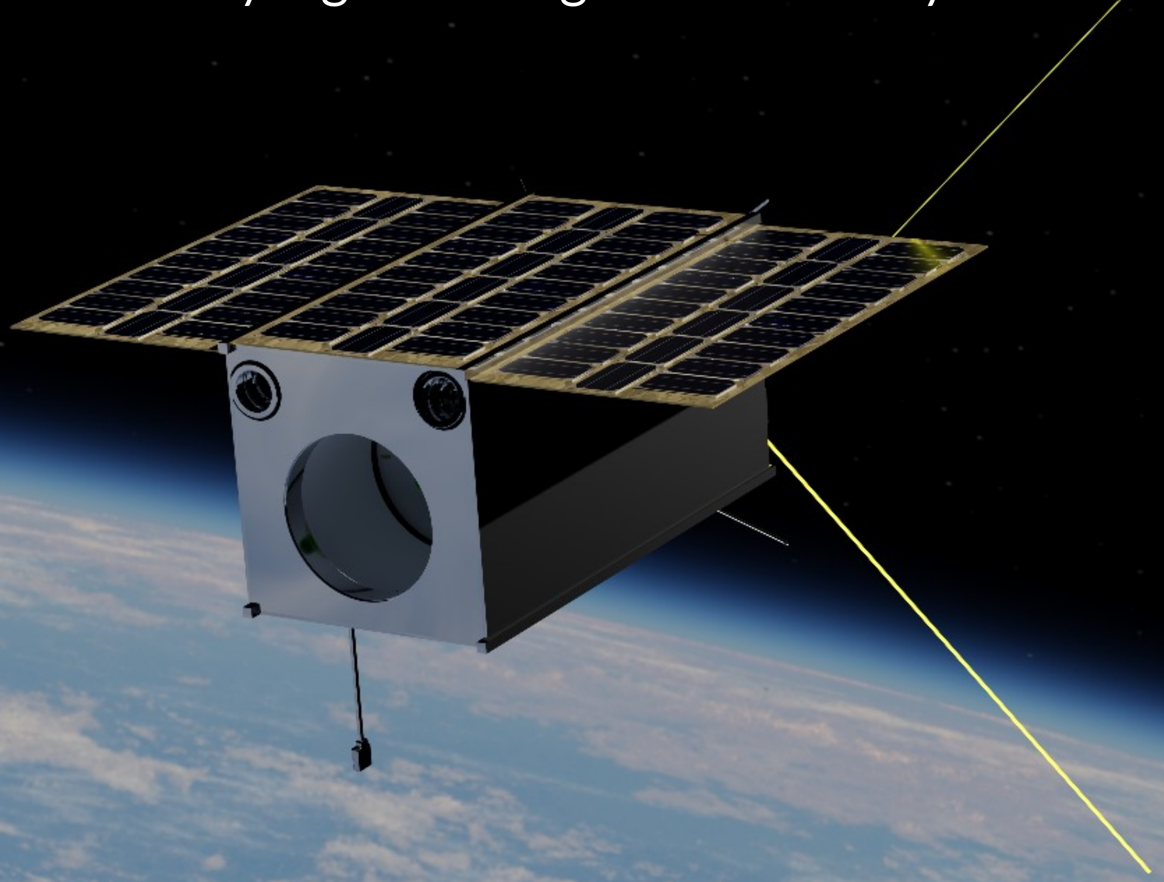
MAUVE

A science satellite from BLUE SKIES SPACE

MAUVE : A UV-Vis spectroscopy facility dedicated to studying the magnetic activity of active stars



Dr. Fatemeh Zahra Majidi
MAUVE Project Scientist
Blue Skies Space Ltd.

BLUE SKIES SPACE

MAUVE

UV-Vis spectroscopy to monitor stars

Time domain astronomy

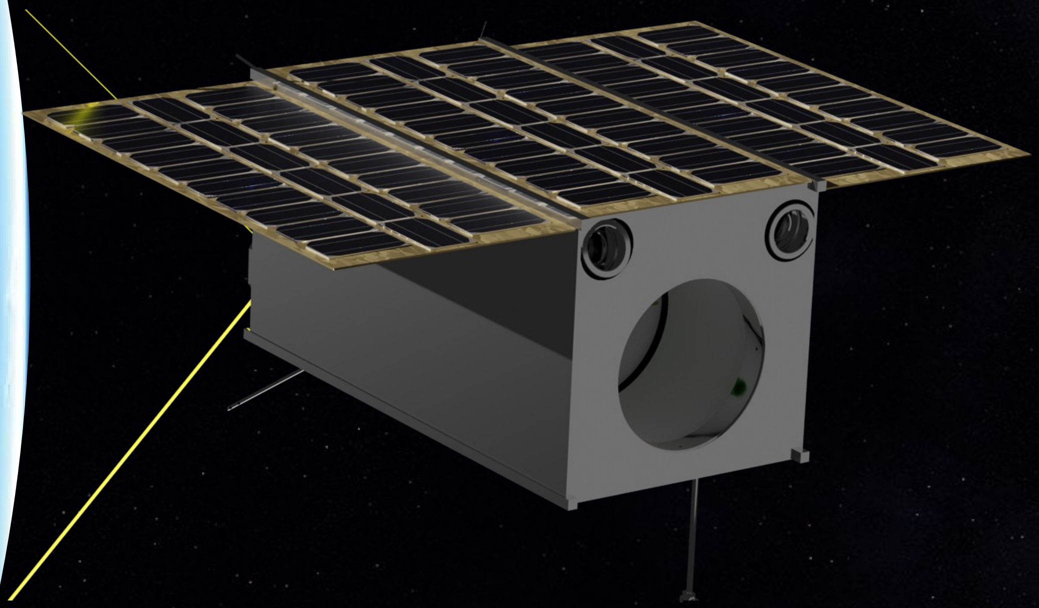
25 kg small satellite

Under construction

To be launched in 2025

C3S

ISISPACE



Funded by the European Union

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 101082738.

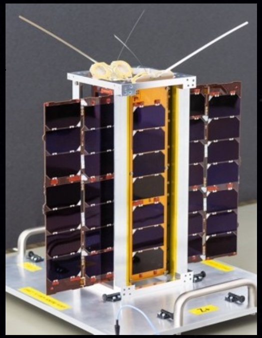
The satellite

BLUE SKIES SPACE

Avionics

Star tracker

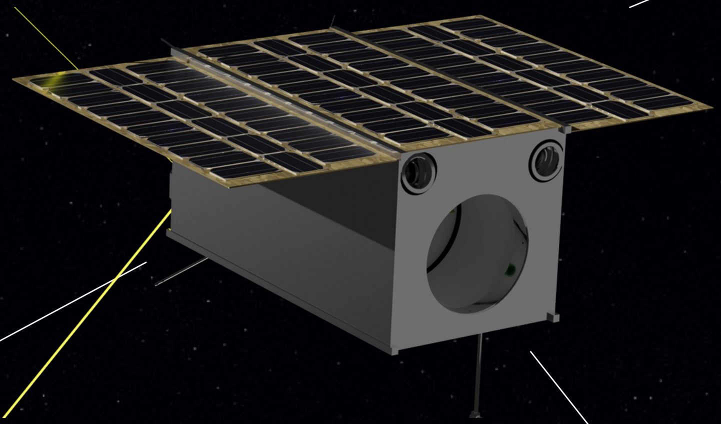
ISISPACE



C3S

C3S 16U Platform

Low-Earth orbit



UV & Visible spectrometer

200 – 700nm

Resolving power 20 - 65

AVANTES MEMBER OF THE NYNOMIC GROUP

HAMAMATSU PHOTON IS OUR BUSINESS

Media Lario

13cm telescope

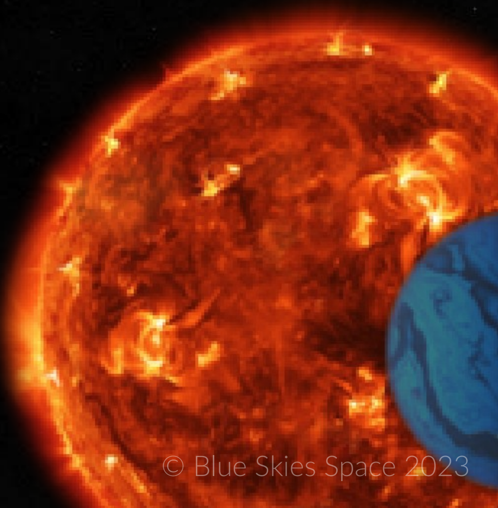
25 kg small sat

Empowering science

A collaborative global platform

New ideas in science

Operating a fleet of science satellites

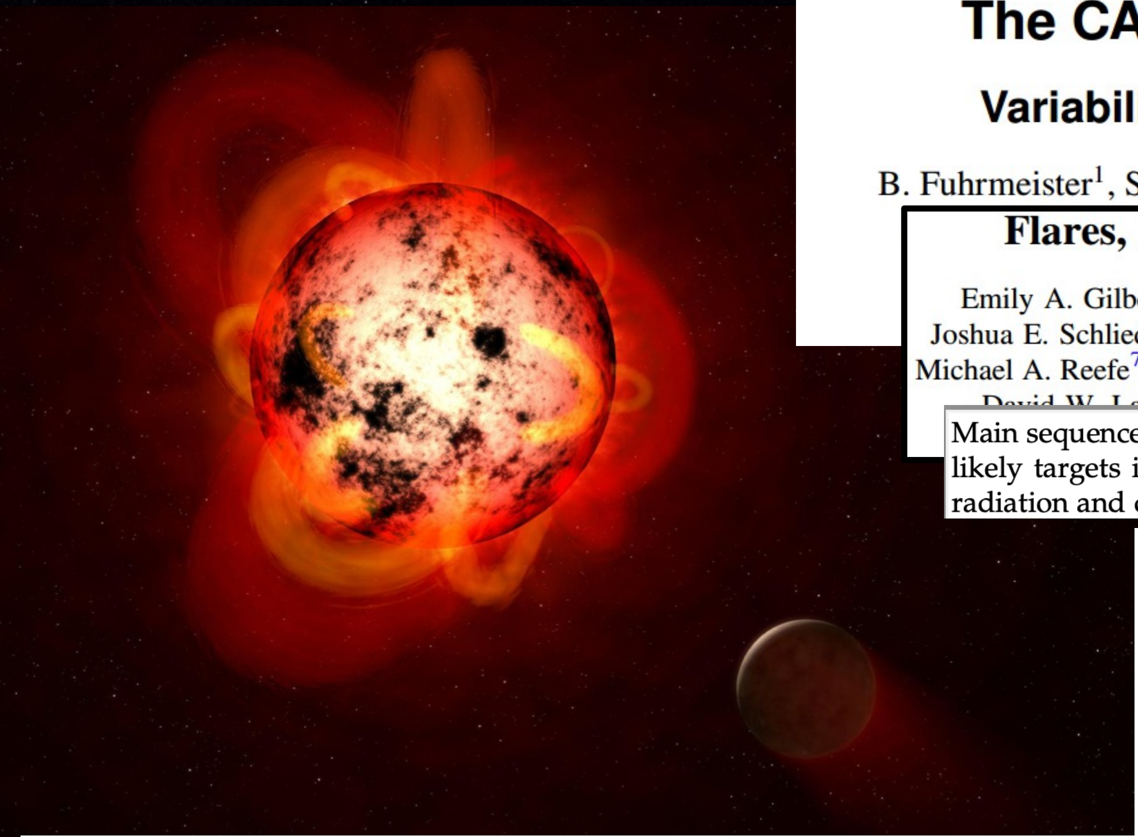



BLUE
SKIES
SPACE
LTD.

Mauve science case I: flaring M-stars

MAUVE

Characterise M-dwarfs and their flaring activity



The CARMENES search for exoplanets around M dwarfs

Variability on long timescales as seen in chromospheric indicators

B. Fuhrmeister[1], S. Czesla[2,1], V. Perdelwitz[3,1], E. Nagel[1], J. H. M. M. Schmitt[1], S. V. Jeffers[4], J. A. Caballero[5],

Flares, Rotation, and Planets of the AU Mic System from TESS Observations

Emily A. Gilbert[1,2,3,4,5], Thomas Barclay[2,4], Elisa V. Quintana[4], Lucianne M. Walkowicz[3], Laura D. Vega[4,6], Joshua E. Schlieder[4], Teresa Monsue[4], Bryson L. Cale[7], Kevin I. Collins[7], Eric Gaidos[8], Mohammed El Mufti[7], Michael A. Reefe[7], Peter Plavchan[7], Angelle Tanner[9], Robert A. Wittenmyer[10], Justin M. Wittrock[7], Jon M. Jenkins[11], David W. Latham[12], George R. Ricker[13], Mark E. Rose[11], S. Seager[13,14,15], Roland K. Vanderspek[13], and

Main sequence M stars pose an interesting problem for astrobiology: their abundance in our galaxy makes them likely targets in the hunt for habitable planets, but their strong chromospheric activity produces high-energy radiation and charged particles that may be detrimental to life. We studied the impact of the 1985 April 12 flare

The Effect of a Strong Stellar Flare on the Atmospheric Chemistry of an Earth-like Planet Orbiting an M Dwarf

Antígona Segura,[1,*] Lucianne M. Walkowicz,[2,*] Victoria Meadows,[3,*] James Kasting,[4,*] and Suzanne Hawley[3]

INFLUENCE OF STELLAR FLARES ON THE CHEMICAL COMPOSITION OF EXOPLANETS AND SPECTRA

Olivia Venot[1], Marco Rocchetto[2], Shaun Carl[3], Aysha Roshni Hashim[3], and Leen Decin[1]
[1] Instituut voor Sterrenkunde, Katholieke Universiteit Leuven, Celestijnenlaan 200D, B-3001 Leuven, Belgium; olivia.venot@kuleuven.be
[2] University College London, Department of Physics and Astronomy, Gower Street, London WC1E 6BT, UK
[3] Department of Quantum Chemistry and Physical Chemistry, Katholieke Universiteit Leuven, Celestijnenlaan 200F, B-3001 Leuven, Belgium
Received 2015 November 17; revised 2016 June 14; accepted 2016 July 26; published 2016 October 14

Localizing flares to understand stellar magnetic fields and space weather in exo-systems

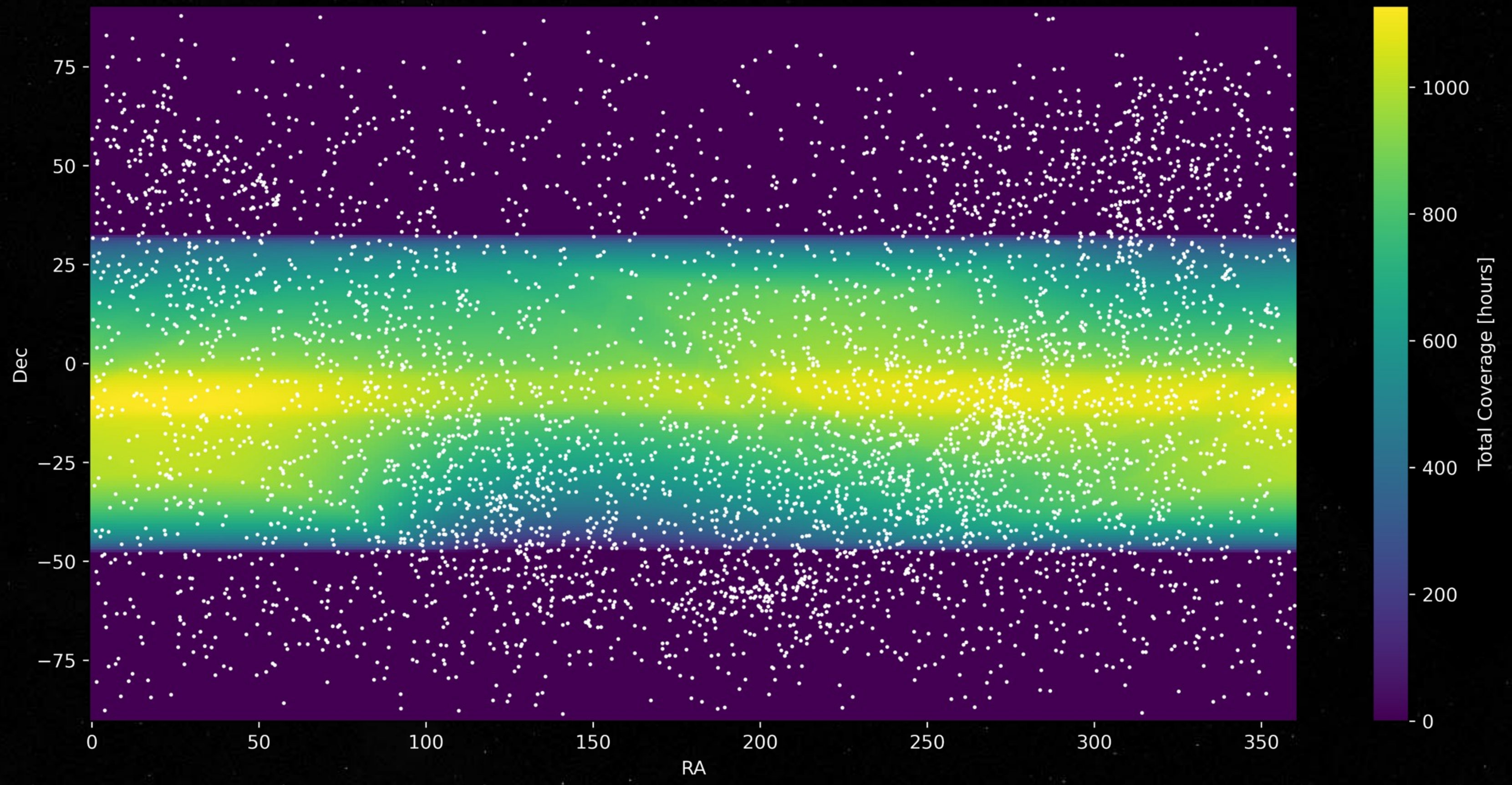
Ekaterina Ilin[1,2] | Katja Poppenhäger[1,2] | Julián D. Alvarado-Gómez[1]

1000+ M-dwarfs

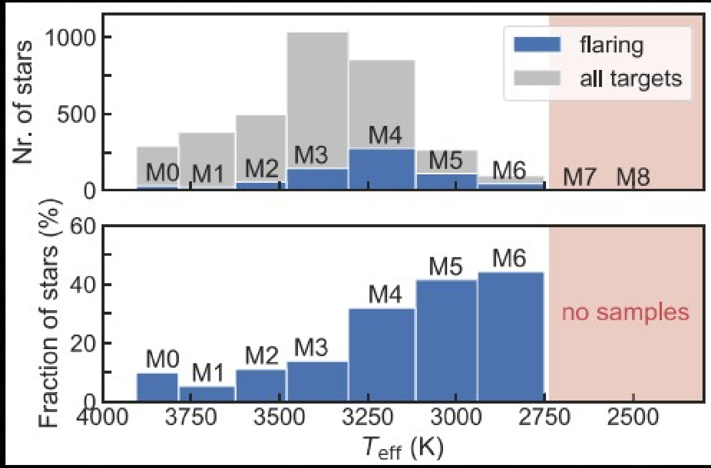
MAUVE

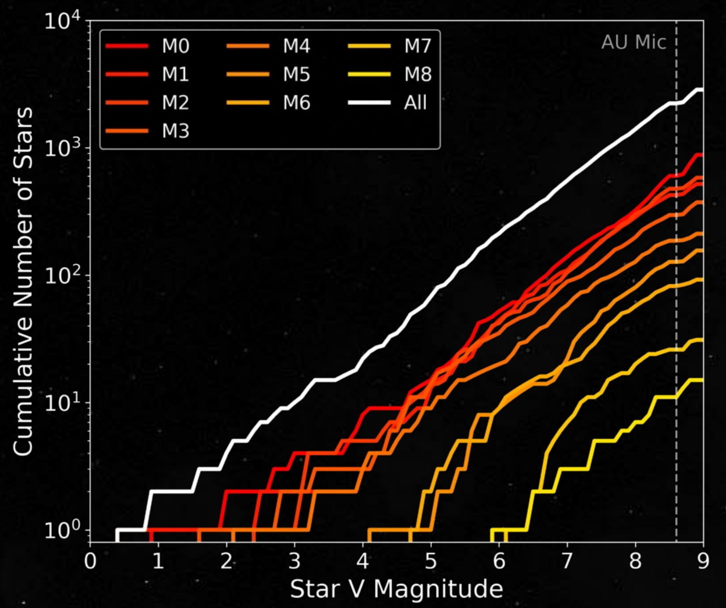
A large sample of stars in the field of regard of Mauve

Günther et al , 2020



Mauve Field of Regard

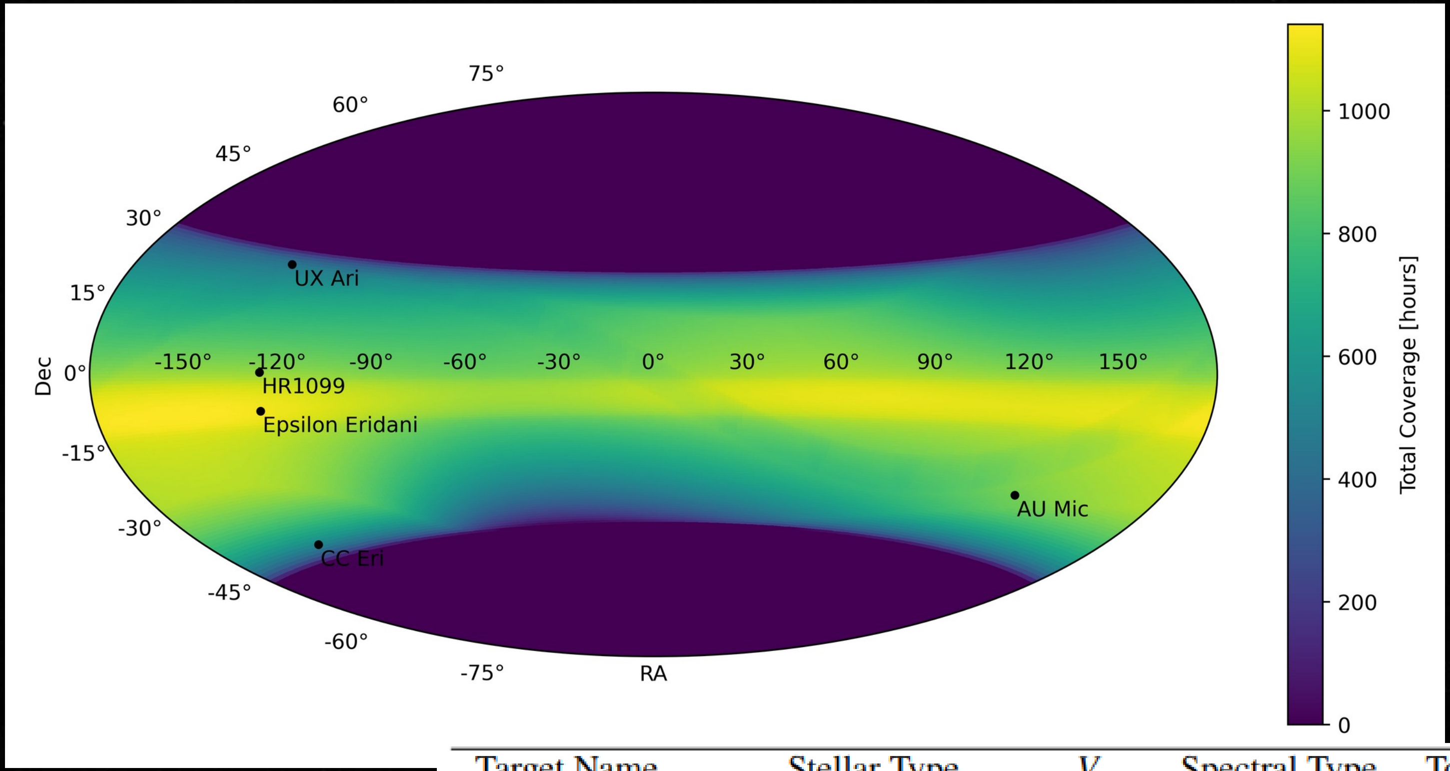




Continuous monitoring of flaring stars

MAUVE

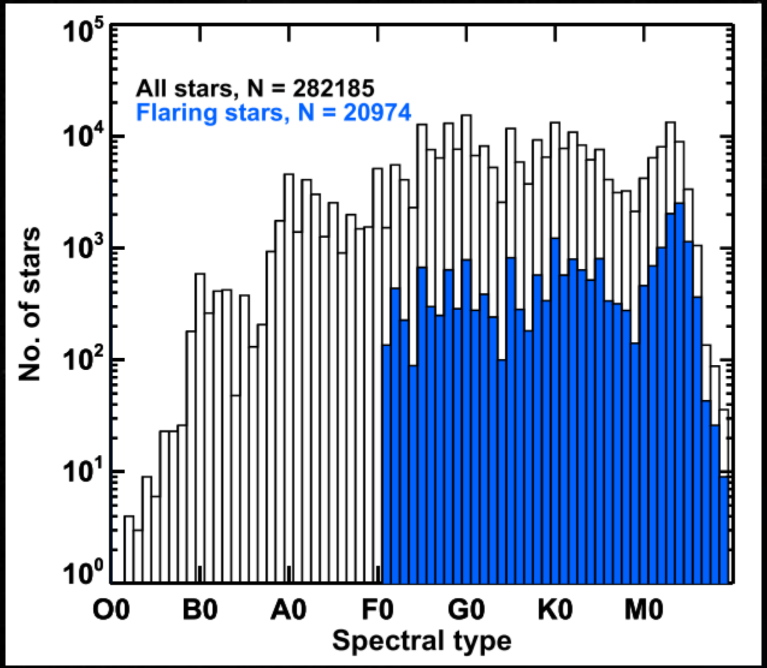
* Some stars in Mauve FoR have ~ 150 hours continuous coverage



Target Name	Stellar Type	V (mag)	Spectral Type	Total available yearly coverage (hours)	Maximum continuous coverage (hours)
AU Mic	BY Dra Variable	8.6	M1	853	0.88
CC Eri	BY Dra Variable	8.8	K7	503	0.85
Epsilon Eridani	BY Dra Variable	3.7	K2	1026	148
UX Ari	RS CVn Variable	6.4	K0+G5	960	1.2
HR 1099	RS CVn Variable	5.9	K2	456	0.88

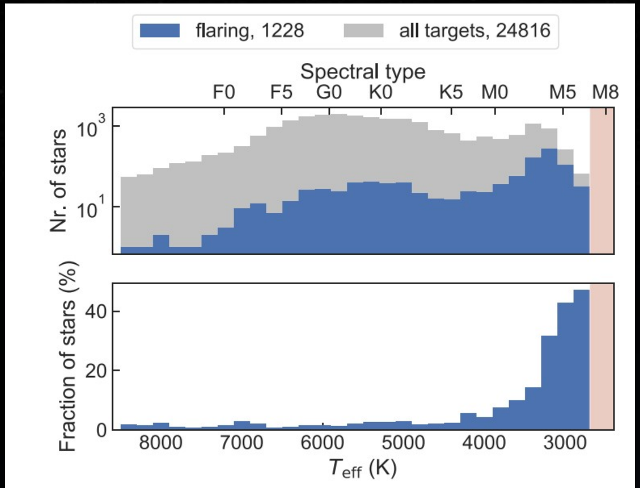
Mauve science case I: flaring stars

Characterise stars and their flaring activity



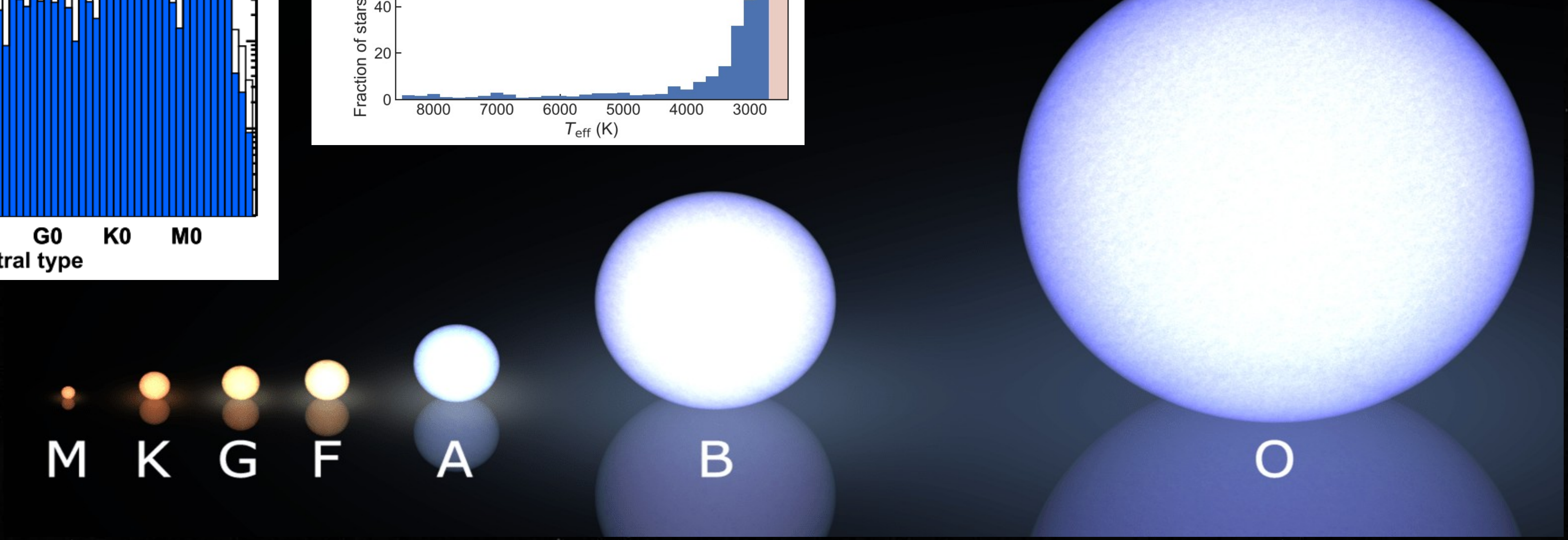
Pietras et al. 2022

(First 39 sectors of TESS observations – 2 min cadence)



Günther et al. 2020

(First two months of the TESS mission – 2 min cadence)

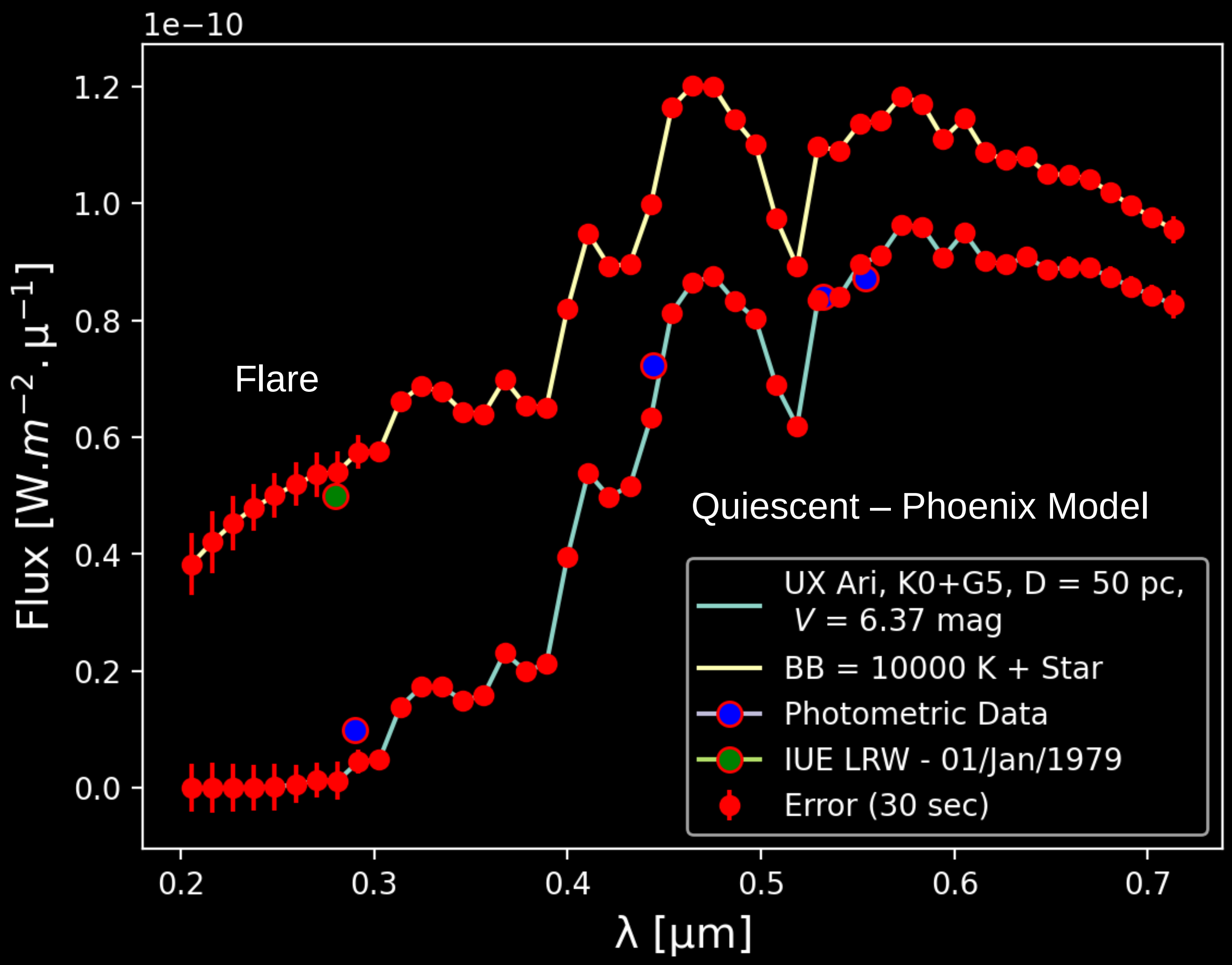


Credit: Wikipedia Commons

Examples of Mauve capabilities

MAUVE

UX Ari Large Flare 01/Jan/1979 – G5 V+K0 IV , *V* = 6.4 mag



Preliminary Results

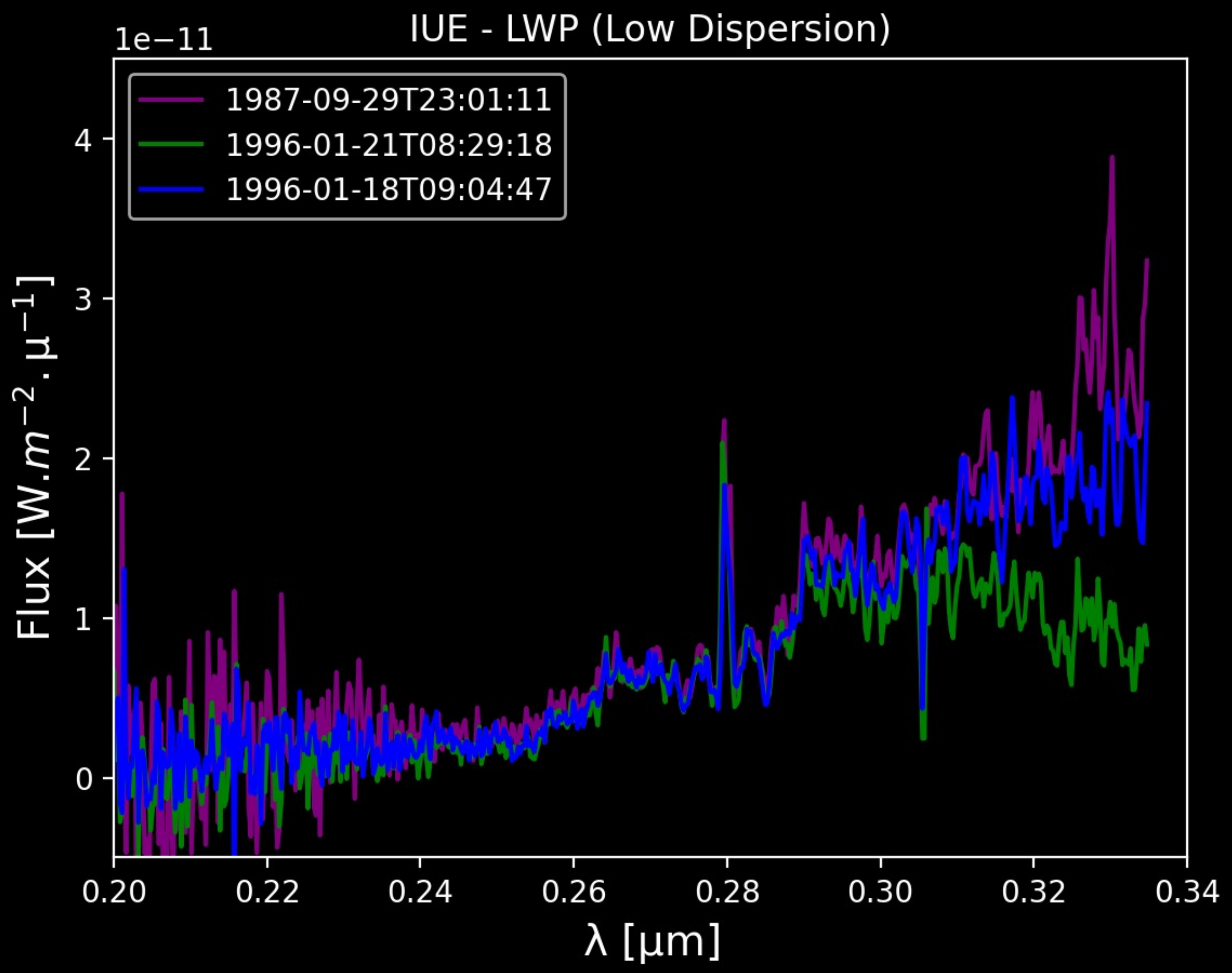
Mauve can monitor flares at different frequencies, with cadence of 30 s

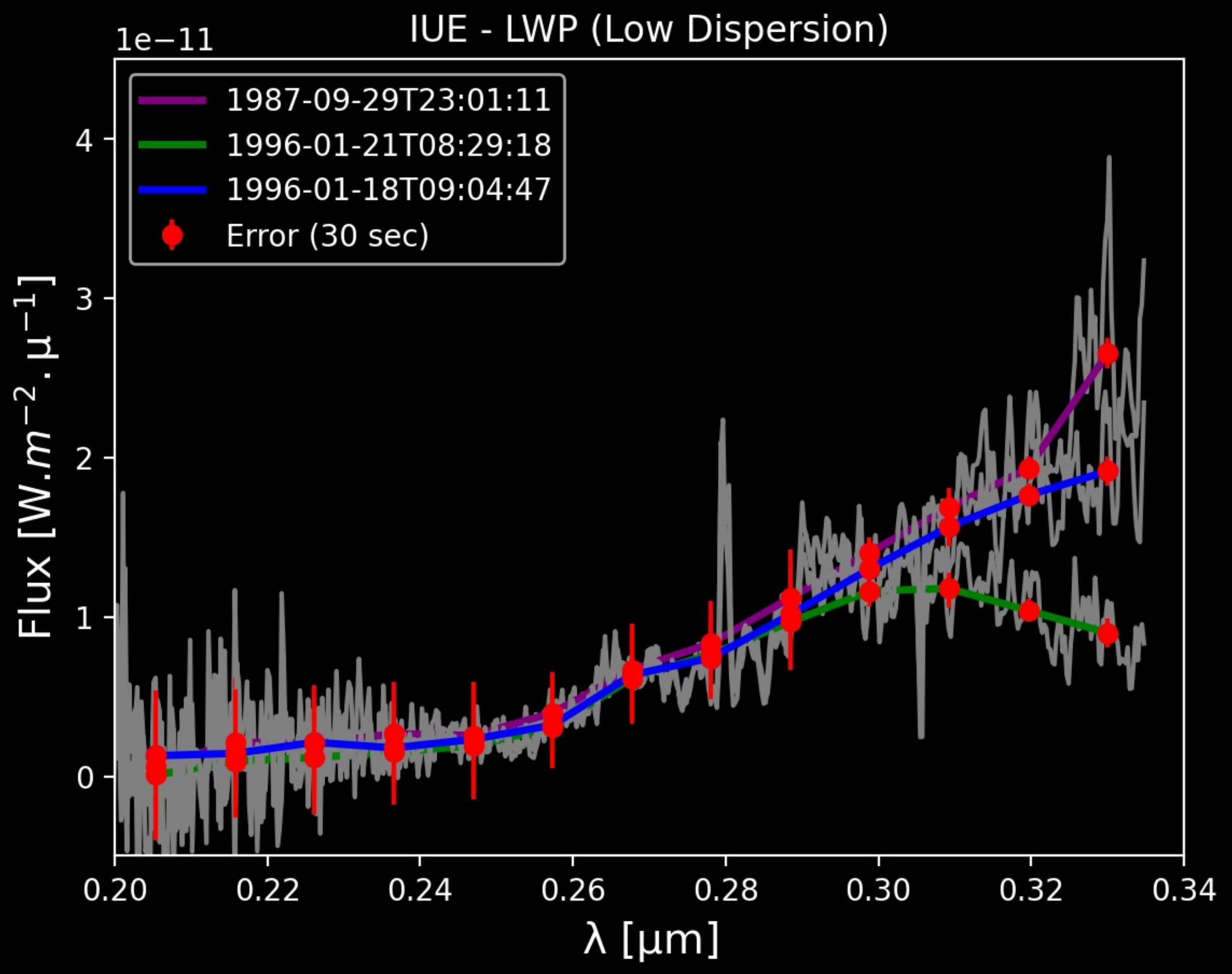
* The alert was received a day before from the Algonquin Radio Observatory.

Examples of Mauve capabilities

Preliminary Results

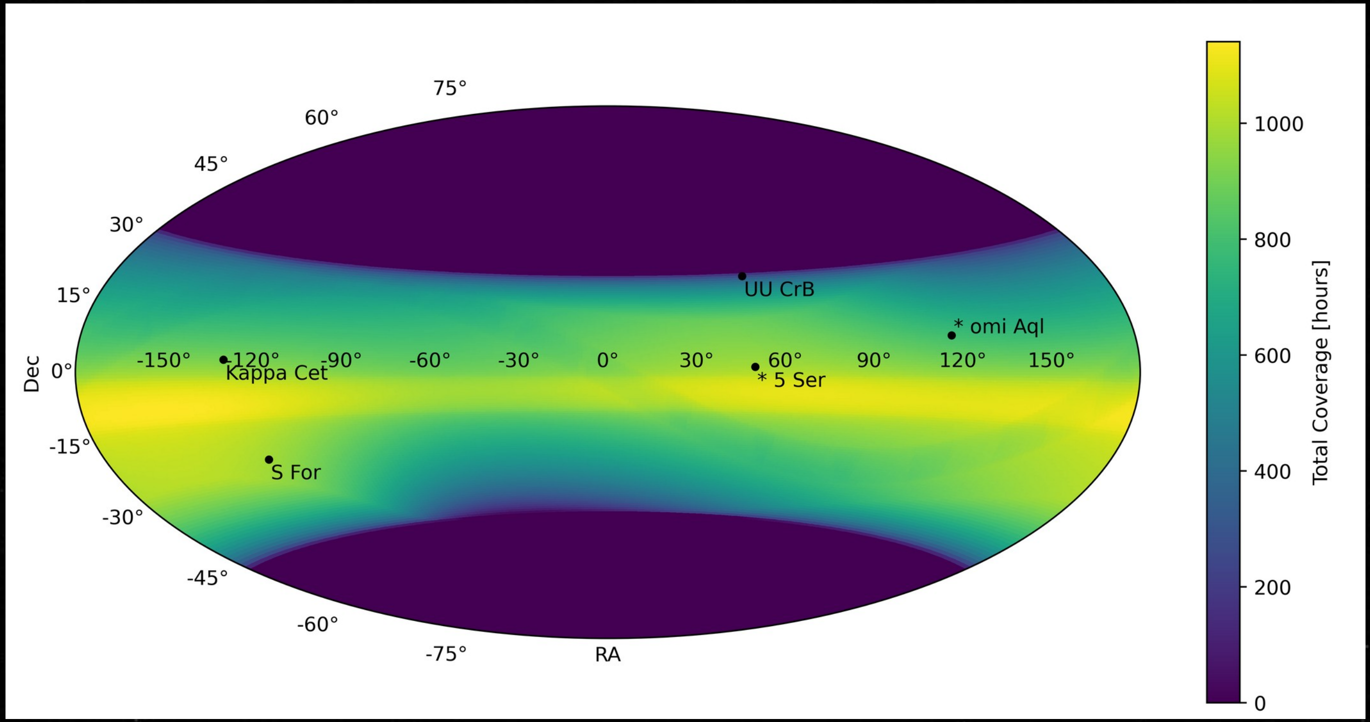
UX Ari Variability in Different Epochs – G5 V+K0 IV , *V* = 6.4 mag





Continuous monitoring of flaring stars

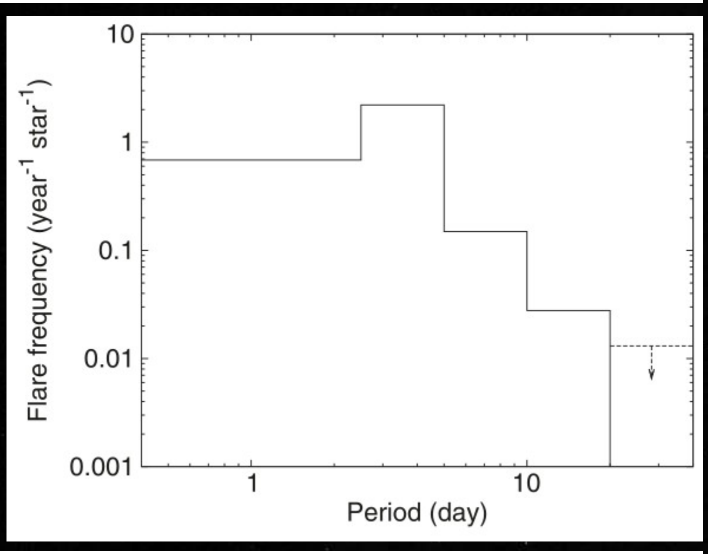
Main Sequence F-G type stars with superflares (Schaefer et al. 2000).



Statistical properties of superflares on solar-type stars based on 1-min cadence data

Hiroyuki Maehara[1*], Takuya Shibayama[2], Yuta Notsu[3], Shota Notsu[3], Satoshi Honda[4], Daisaku Nogami[3] and Kazunari Shibata[5]

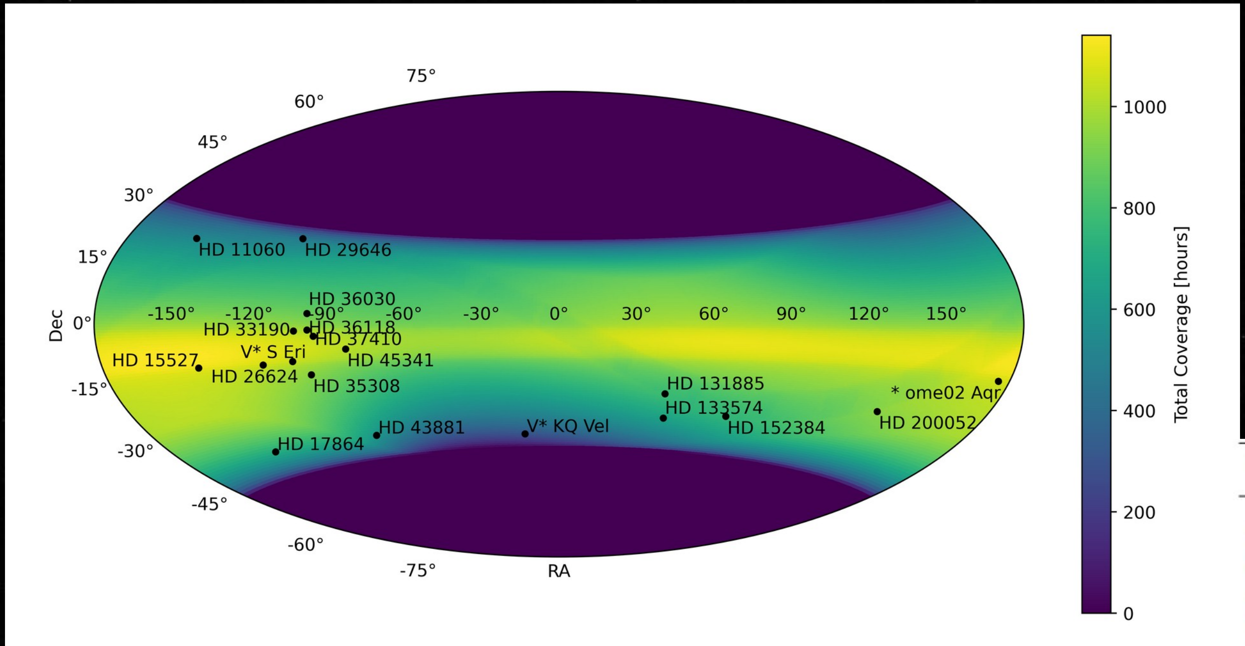
G-type
(MS, Kepler)
~$[10^{33\text{-}36}$ erg]



Target Name	Stellar Type	V (mag)	Spectral Type	Total available yearly coverage (hours)	Maximum continuous coverage (hours)
κ Cet	BY Dra Variable	4.85	G5V	912.6	1.1
UU CrB	High Proper Motion Star	8.6	F8	263.5	0.9
S For	Double or Multiple Star	8.6	G1V	983.9	1.0
* omi Aql	High Proper Motion Star	5.16	F8V	794.7	1.0
* 5 Ser	Rotating Variable	5.1	F8IV	988.9	1.1

Continuous monitoring of flaring stars

Several reference Main Sequence A-B type flare stars observed with TESS (Balona 2021), with typical energy range of $10^{34\text{-}35}$ erg for A-stars.



Superflares occur in about 0.004% of cool dwarfs observed in the first 2 months of the TESS mission (Günther et al. 2020), compared to 1% for A-type stars.

Target Name	Stellar Type	V (mag)	Spectral Type	Total available yearly coverage (hours)	Maximum continuous coverage (hours)
HD 37410	Star	6.8	A1/2V	1033.3	229.2
HD 11060	Star	8.3	A0	535.8	0.9
HD 200052	Star	6.0	A3V	938.6	0.9
HD 152384	Star	7.04	A0V	757.2	0.9
HD 36118	Star	8.9	B9V	997.1	88.5
HD 133574	Star	8.7	A9/F0V	655.5	0.9
* ome02 Aqr	Eruptive Variable	4.5	B9V	1065.9	1.3
V* S Eri	delta Sct Variable	4.8	B9V	1048.8	133.8
V* KQ Vel	α^2 CVn Variable	6.1	Ap(SiCr)	298.3	0.88
HD 29646	Star	5.7	A2V	461.1	0.88
HD 17864	Double or Multiple Star	6.4	A0V	708.9	0.88
HD 33190	Star	8.2	B8III	1013.1	123.2
HD 36030	Star	8.96	B9V	885.6	1.1
HD 26624	Star	7.9	A2/3V	1061.9	15.7
HD 43881	Star	8.2	A2V	600.3	0.9
HD 15527	Star	9.1	A9V	1111.9	97.6
HD 131885	Star	6.9	A0V	779.4	0.9
HD 35308	Star	8.2	A0V	944.5	1.1
HD 45341	Star	8.8	A3II	1025.1	275.3

Megaflares on PMS stars

X-ray Super-Flares From Pre-Main Sequence Stars: Flare Energetics And Frequency

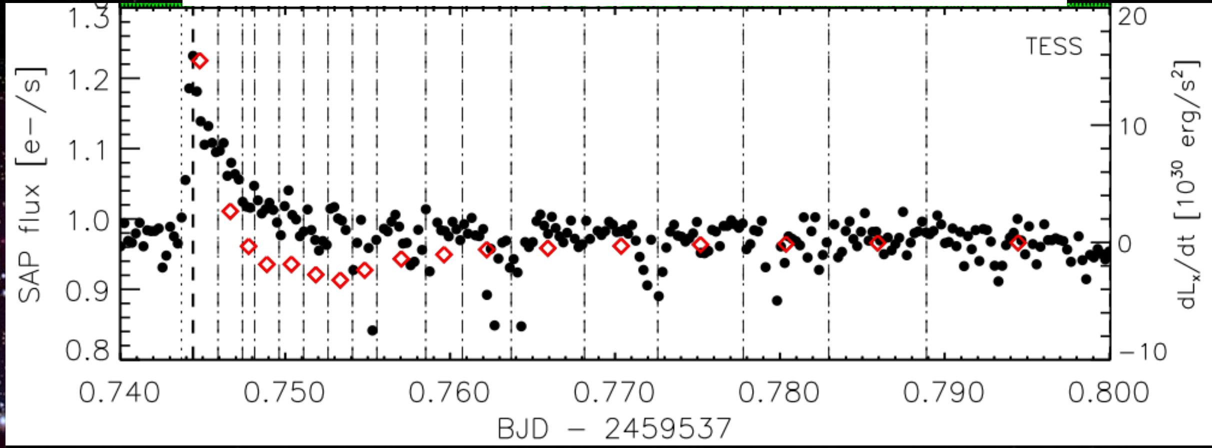
Konstantin V. Getman[1] and Eric D. Feigelson[1,2]

https://www.nasa.gov/image-article/give-take-of-mega-flares-from-stars/

The Great Flare of 2021 November 19 on AD Leo

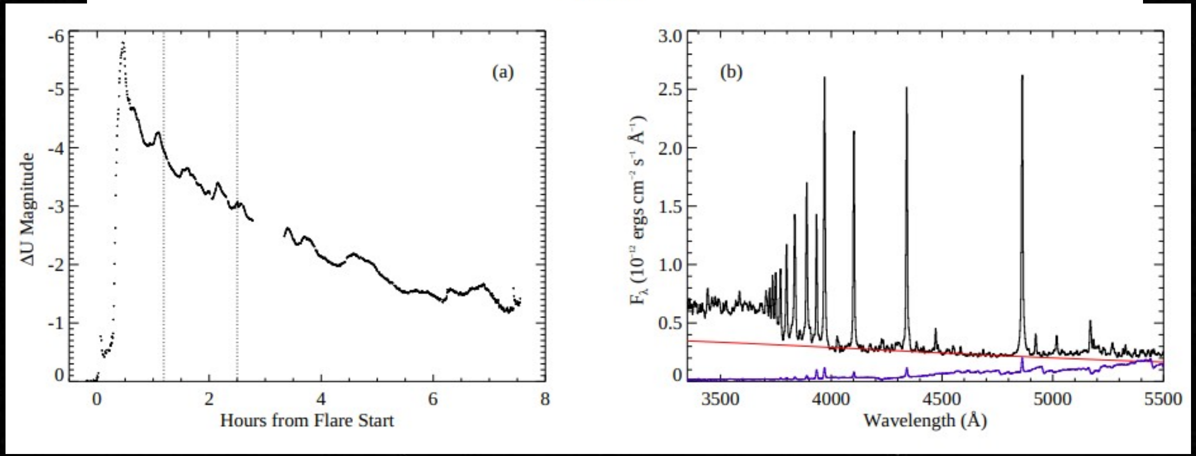
Simultaneous *XMM-Newton* and *TESS* observations

B. Stelzer[1,2], M. Caramazza[1], S. Raetz[1], C. Argiroffi[2,3], and M. Coffaro[1]



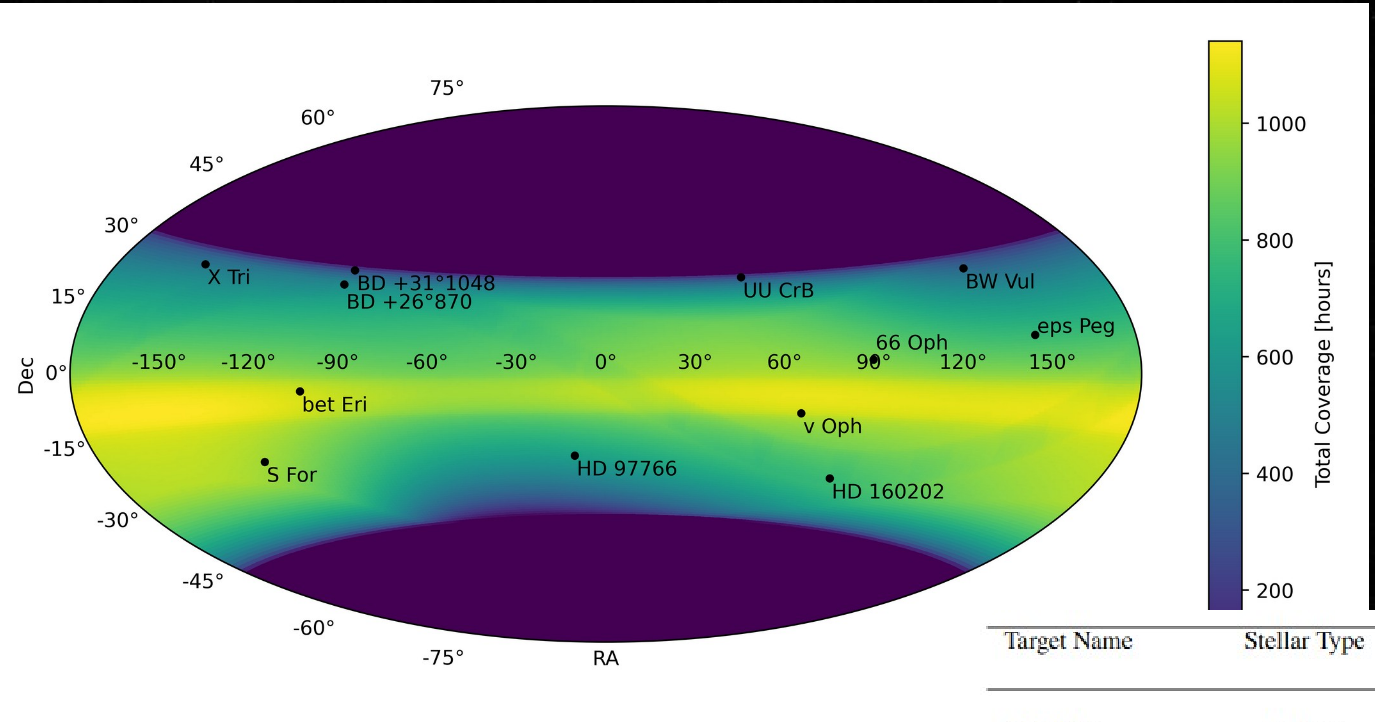
A White Light Megaflare on the dM4.5e Star YZ CMi[1]

Adam F. Kowalski[2], Suzanne L. Hawley[2], Jon A. Holtzman[3], John P. Wisniewski[2,4], Eric J. Hilton[2]



Continuous monitoring of flaring stars

Several nominal stars exhibiting megaflares (‘flashes?’, ~10^{40} erg, Schaefer 1988).



** Flares with energy range > 10^{37} erg

FLASHES FROM NORMAL STARS

Bradley E. Schaefer
NASA/Goddard Space Flight Center

Received 1988 February 1; accepted 1988 July 29

Target Name	Stellar Type	V (mag)	Spectral Type	Total available yearly coverage (hours)	Maximum continuous coverage (hours)
* 66 Oph	Be Star	4.6	B2Ve	923.8	1.1
V* BW Vul	beta Cep Variable	6.5	B2IIIv	388.0	0.9
BD +31°1048	Variable Star	6.0	B9.5III-IV	263.6	0.9
HD 160202	Be Star	6.75	B5Ve	780.8	0.9
BD +26°870	Double or Multiple Star	8.6	B9.5IV	549.8	0.9
* bet Eri	High Proper Motion Star	2.8	A3IV	1059.3	256.1
V* X Tri	Eclipsing Binary	9.0	A7V	452.5	0.9
UU CrB	High Proper Motion Star	8.6	F8	263.5	0.9
S For	Double or Multiple Star	8.6	G1V	983.9	1.0
HD 97766	High Proper Motion Star	7.94	K0III	649.3	0.9
V* V Oph	Carbon Star	7.3	C-N:4	1051.7	135.5
* eps Peg	Long-Period Variable	2.4	K2Ib-II	773.4	1.0

Mauve science cases

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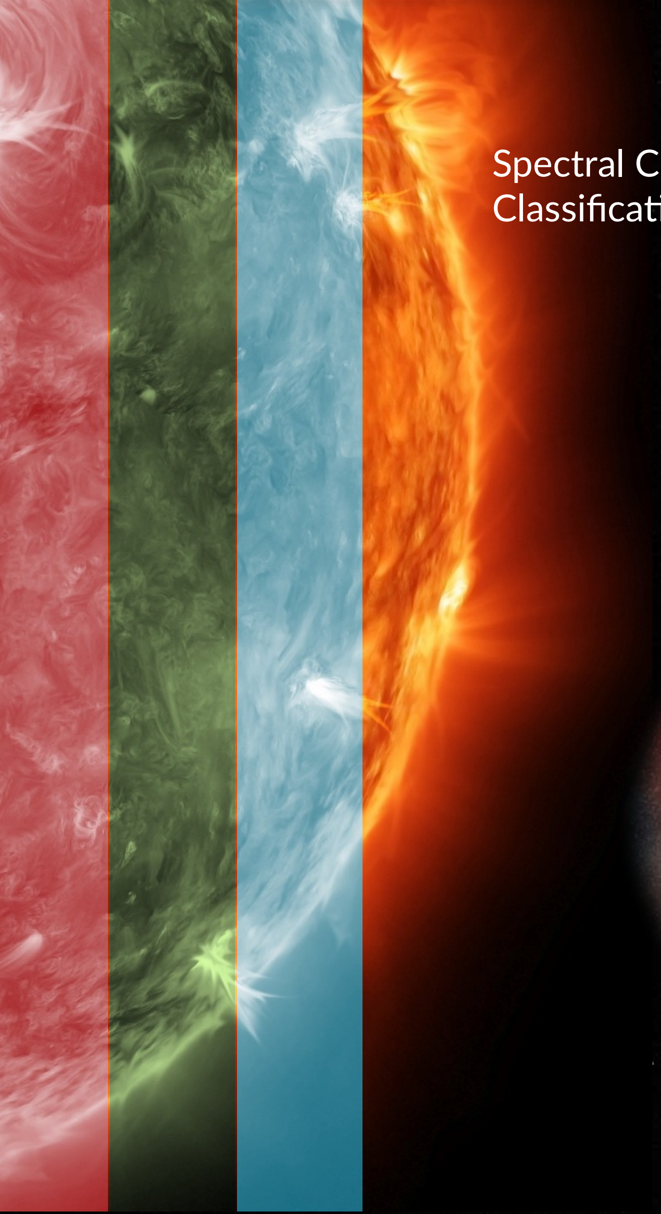
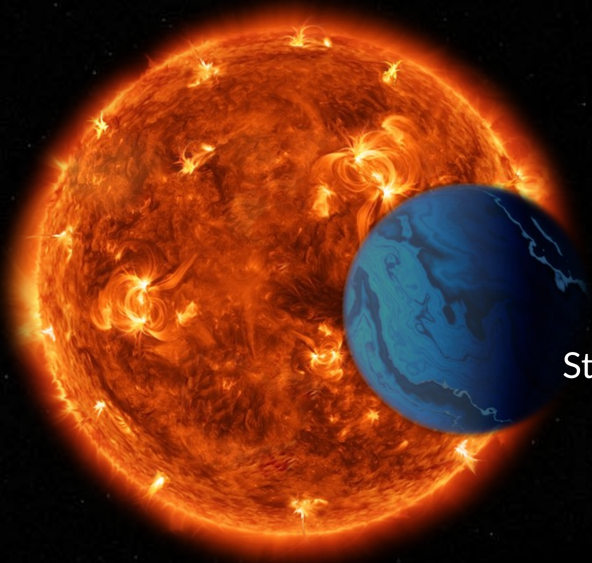
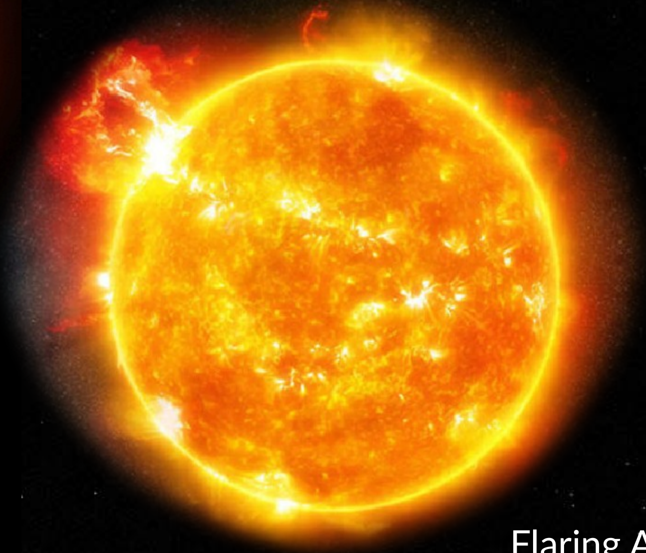


Spectral Characterisation &
Classification of Stars



Star-Planet Interactions



Flaring Activity

Disks Evolution & Young
Stellar Objects

Image: AAS

Acknowledgement of EU Funding

The Mauve satellite is being developed in close collaboration with consortium partners in the UK and Europe. Blue Skies Space Ltd. and Blue Skies Space Italia S.R.L. are responsible for the overall project delivery and payload provision, C3S Electronikai Fejleszto KFT for the satellite platform, with support from ISIS – Innovative Solutions in Space BV for high-performance AOCS. The University of Kent and the Europlanet network will help liaise with the scientific community to help maximise the scientific return of Mauve.

Funded by the European Union

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 101082738.

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bssl.space/mauve

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Spectral Characterization of Stars with Mauve