

Followup and Monitoring Observations of MAXI Flare Stars in Optical Bands

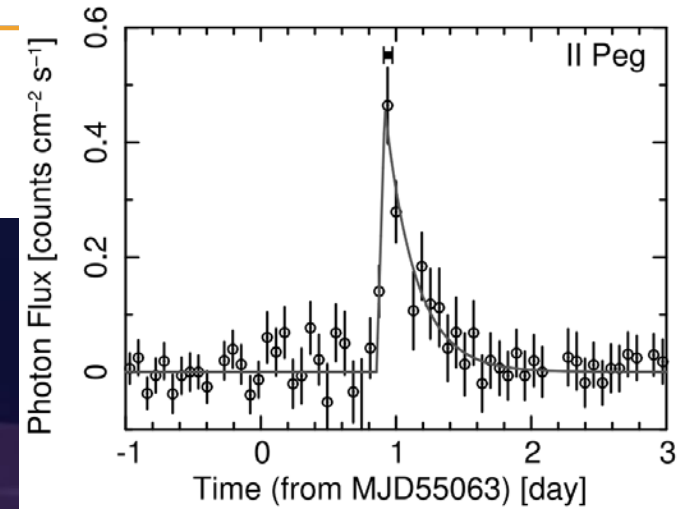


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(Chuo University)**



Stellar flare study of MAXI (2009 - present)

- Operated from 2009-08-15
- Onboard International Space Station
- Survey type detector with the past highest sensitivity

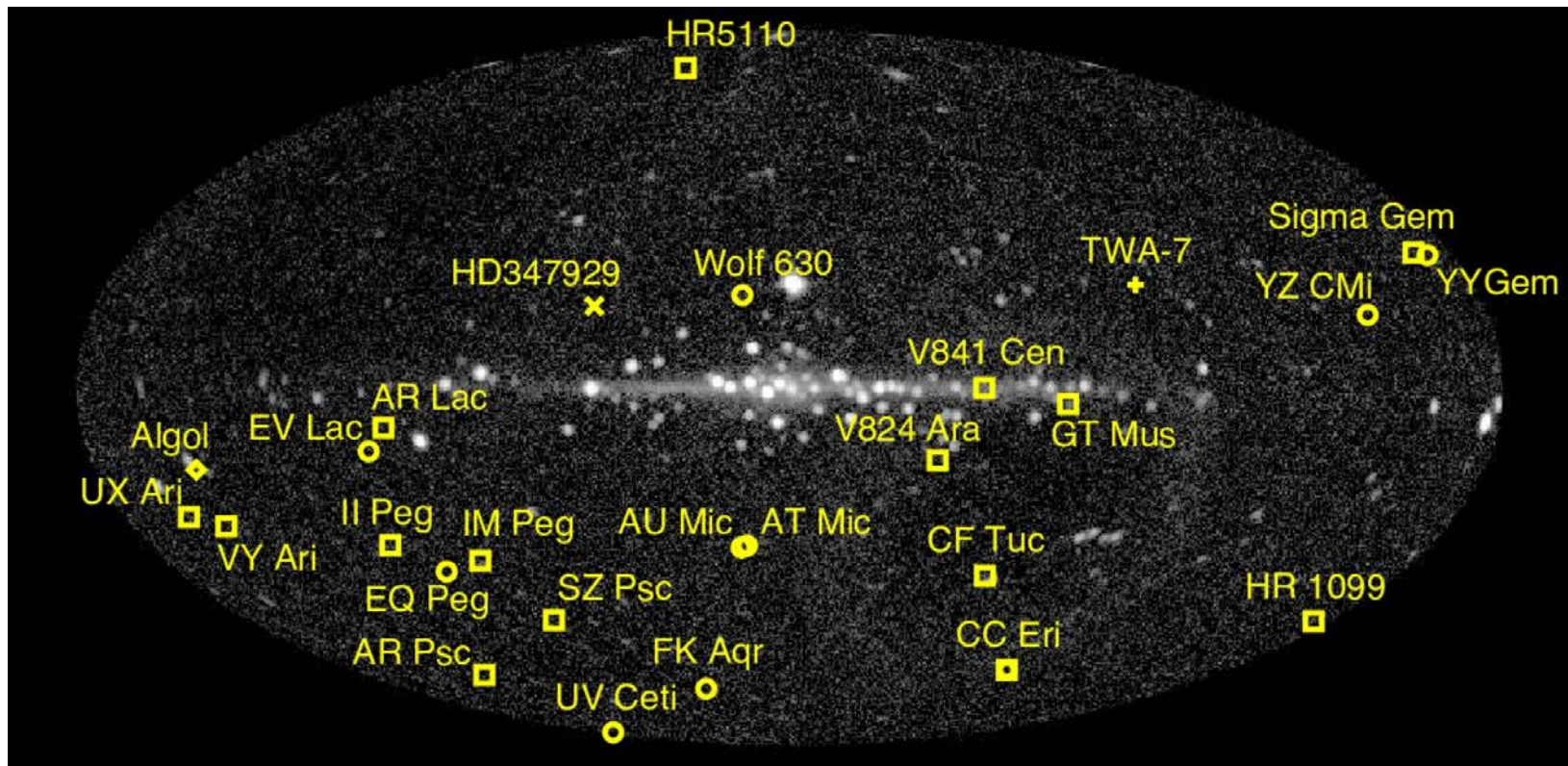


Flares searched with MAXI

MAXI-detected Stars

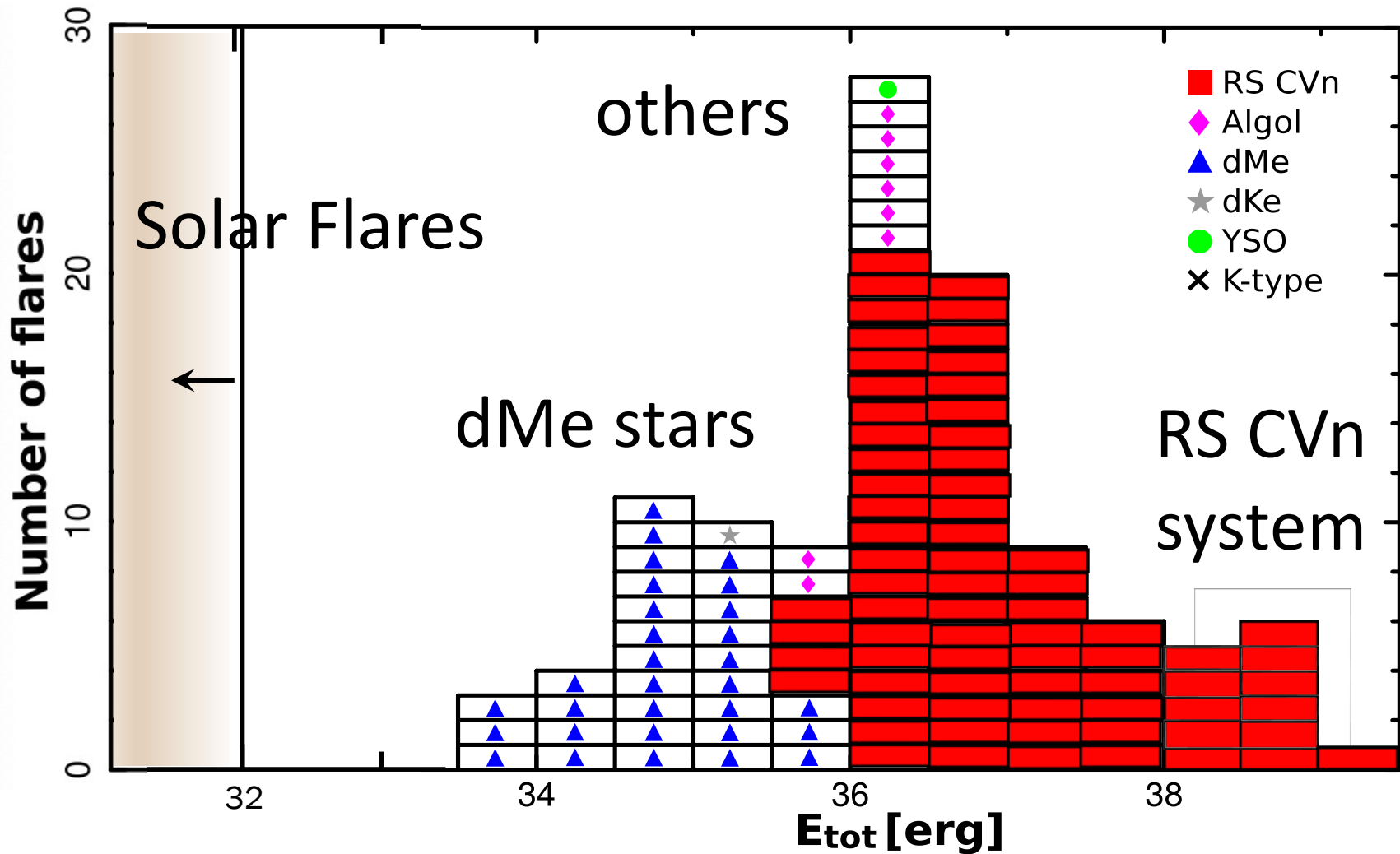
2009 Aug. 15th ~ 2019 Aug. 15th

Sasaki Doctor thesis 2021



We detected 214 flares from 28 stars

Flare energy histogram (2009 Aug - 2019 June) Sasaki Doctor thesis 2021



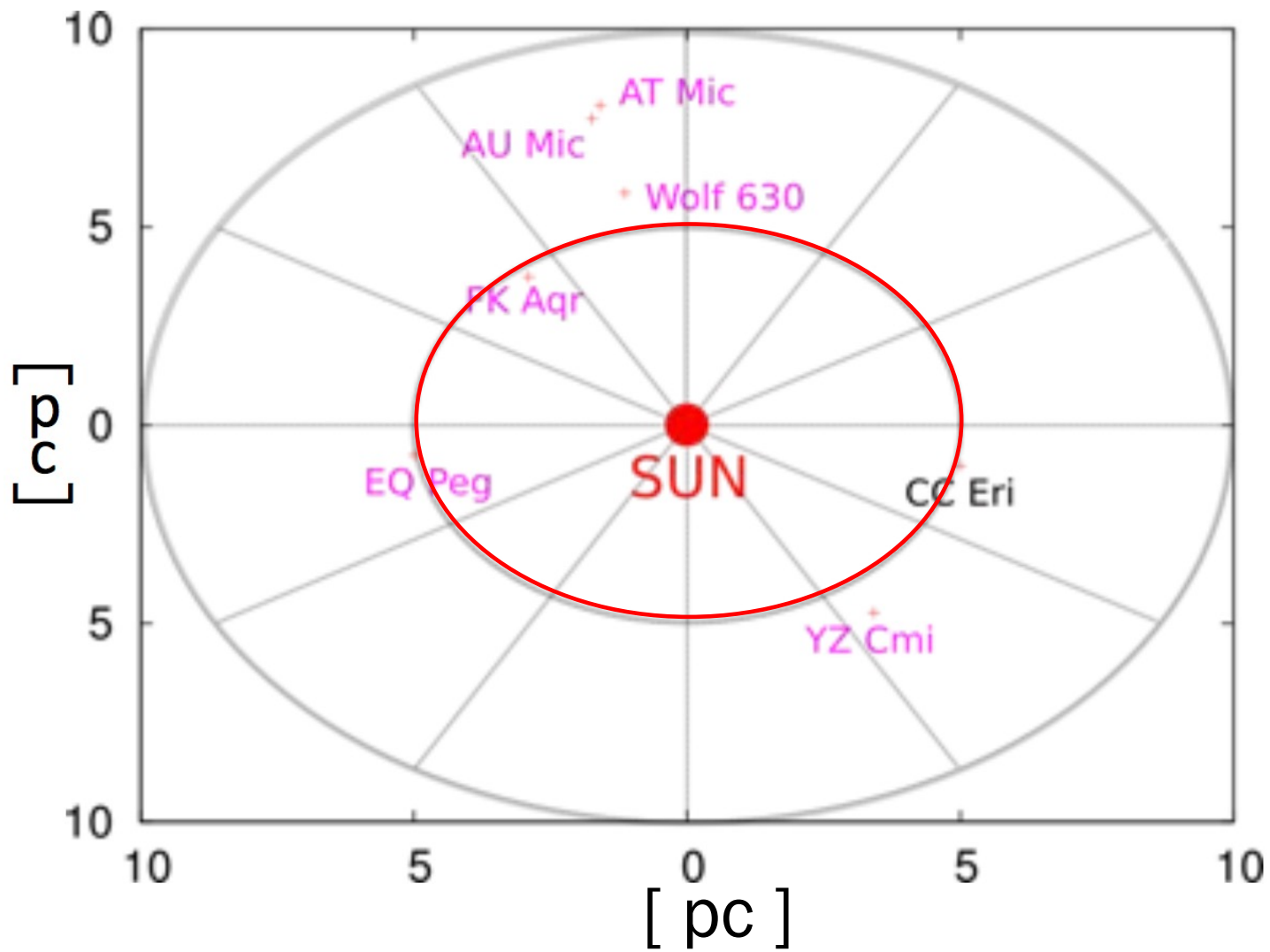
More than 10^4 times larger than Solar Flares



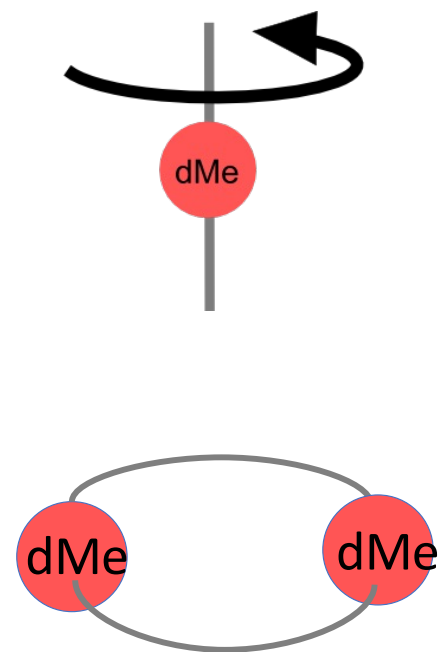
Here, in this meeting, we call them

“MAXI Flares”.

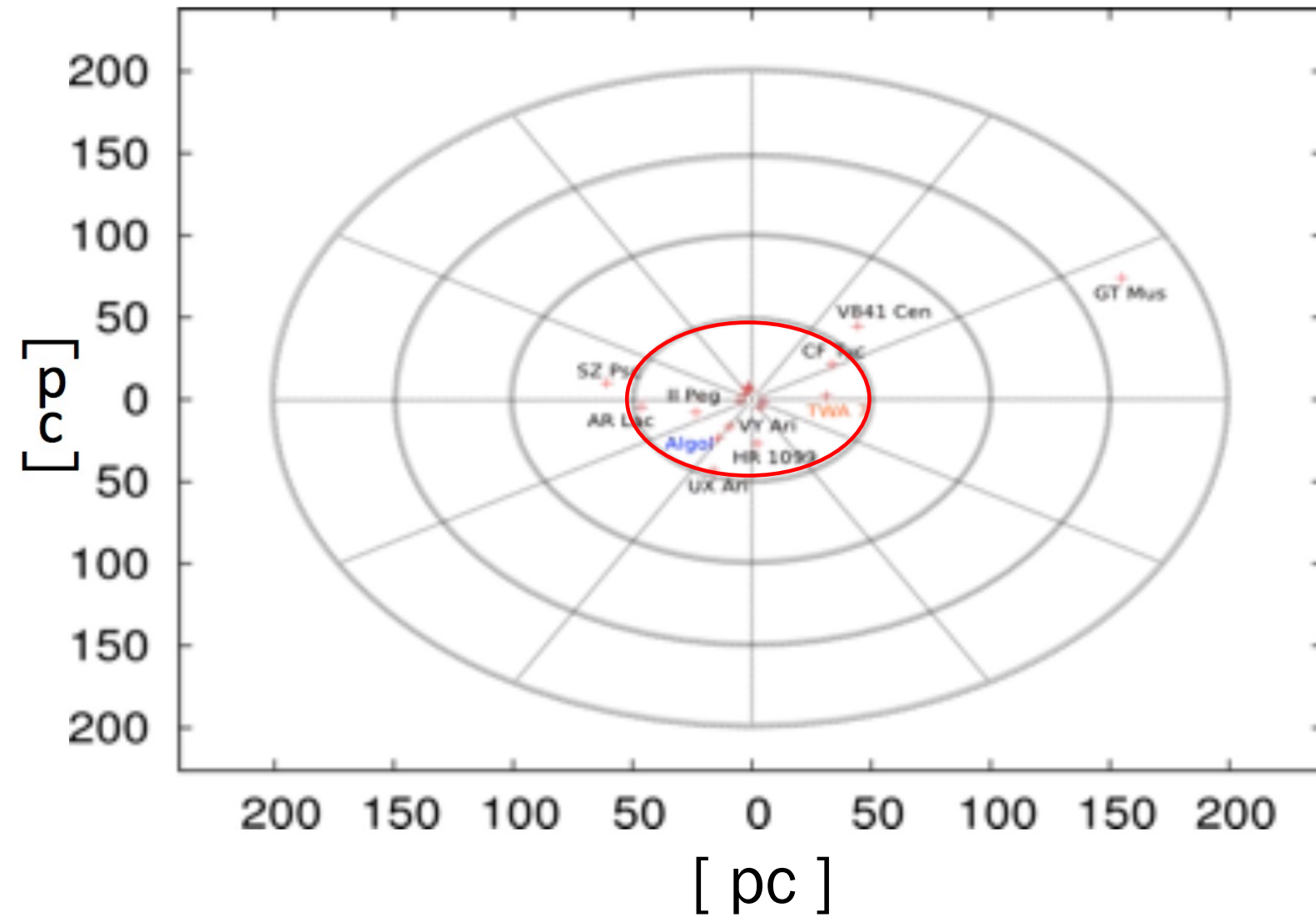
Distance: ~ 5 pc



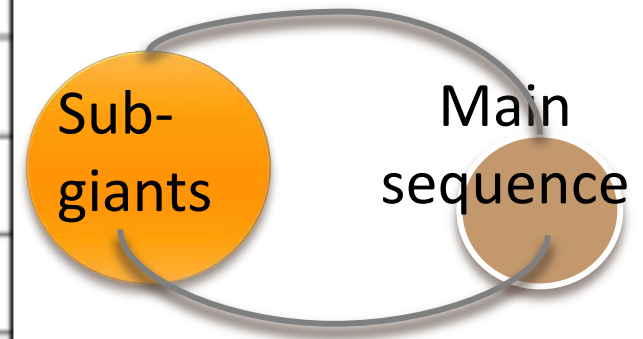
MAXI-detected
dMe stars



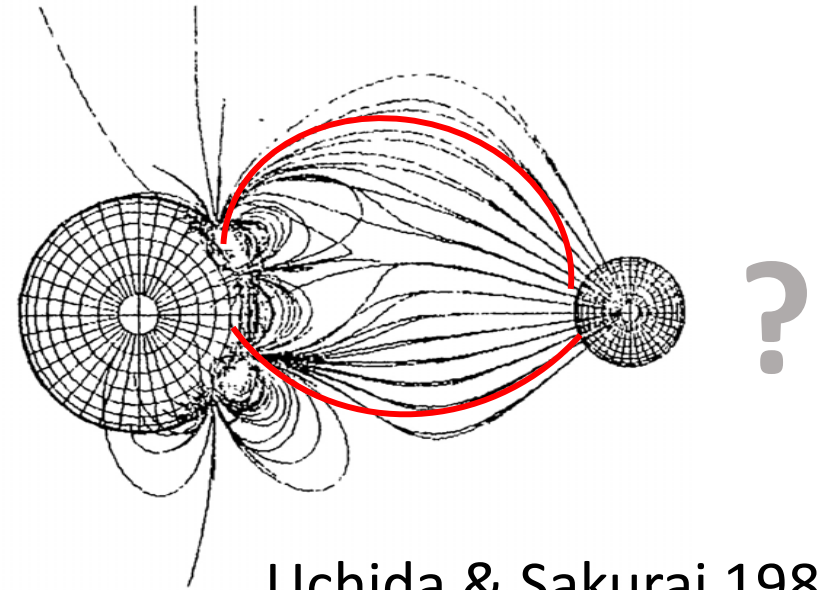
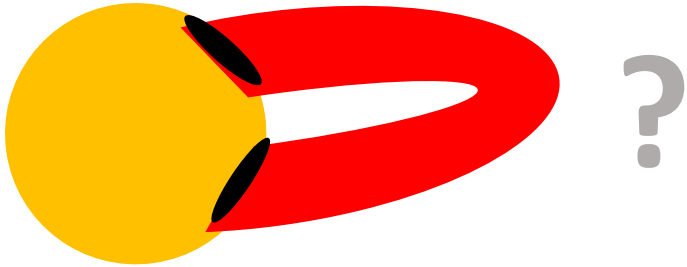
Distance: ~ 50 pc



MAXI-detected
RS CVns stars



Geometry of the flaring plasma



Uchida & Sakurai 1985

or other geometry ?

How can we obtain the picture of the geometry ?

Timing → **OK with MAXI**

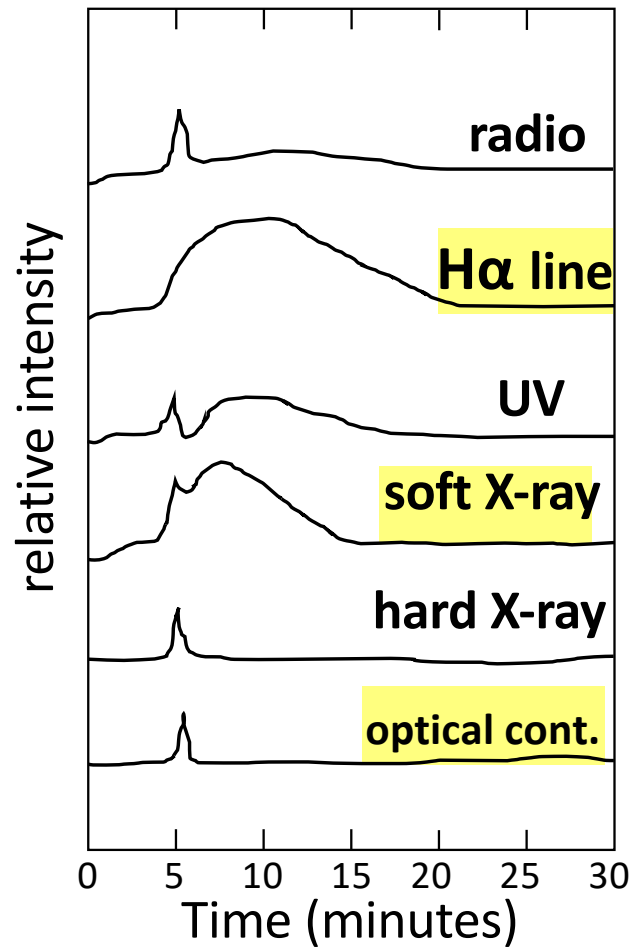
Time scale → **OK with MAXI**

Thermal kinetics → **OK with MAXI**

Dynamism → **NO for MAXI**

Then which tool we use?

light curves of solar flares
(Based on Kane 1974)



← We can use this line !

Optical Follow-up

with CHAO

(CHuo-university Astronomical Observatory)



MAXI
From 2009

Follow-up with SCAT



From 2013
CAT

SCAT

Roof Top of Chuo Univ. In Tokyo

SCAT (From 2016)
(Spectroscopic Chuo-university
Astronomical Telescope)



Diameter : **0.36m**
low dispersion spectroscopy
: **600 (@ H α line)**

FAST FOLLOW-UP WITH PHAST

PHAST in

CHAO

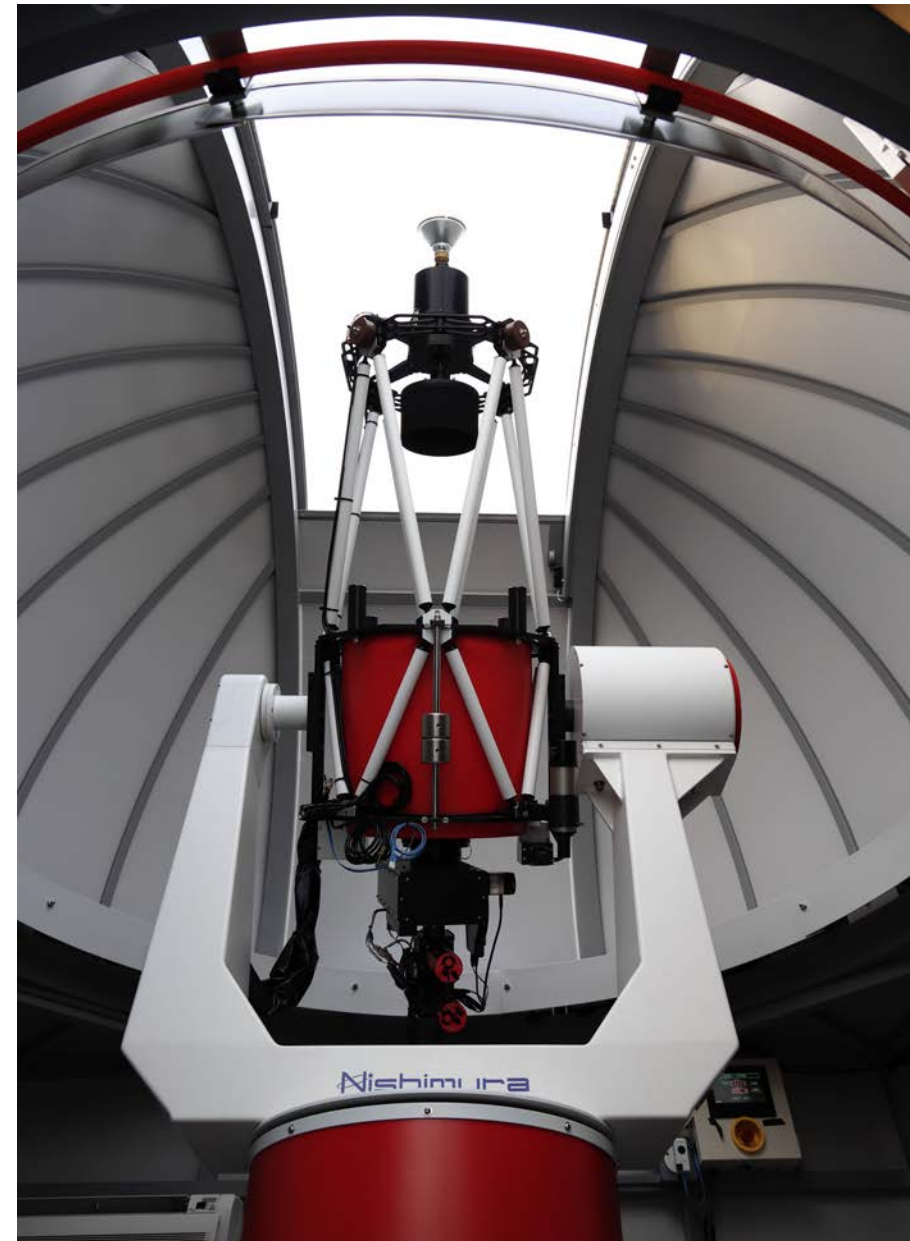
(CHuo-university
Astronomical
Observatory)

installed on 2021 Mar.

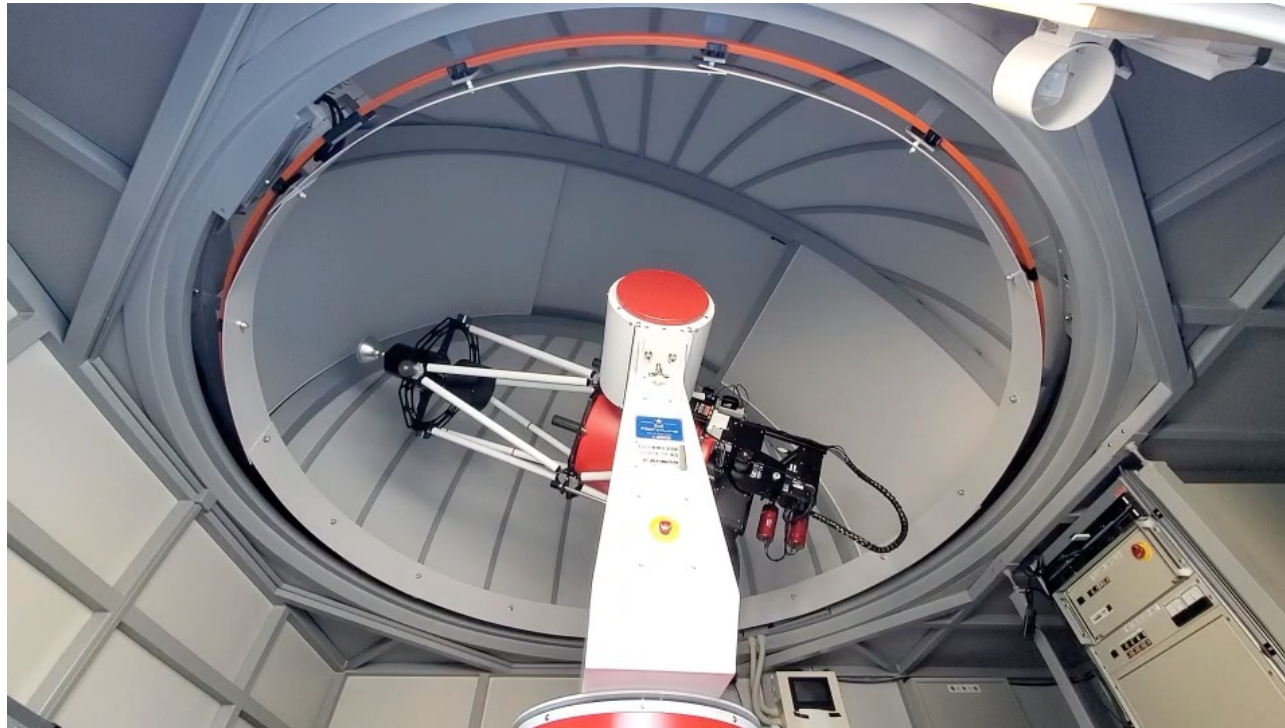


PHAST (PHotometric And Spectroscopic Telescope)

- 40 cm aperture
- High-dispersion spectroscopy
R = 19000 (6563 Å)
- Simultaneous Photometry

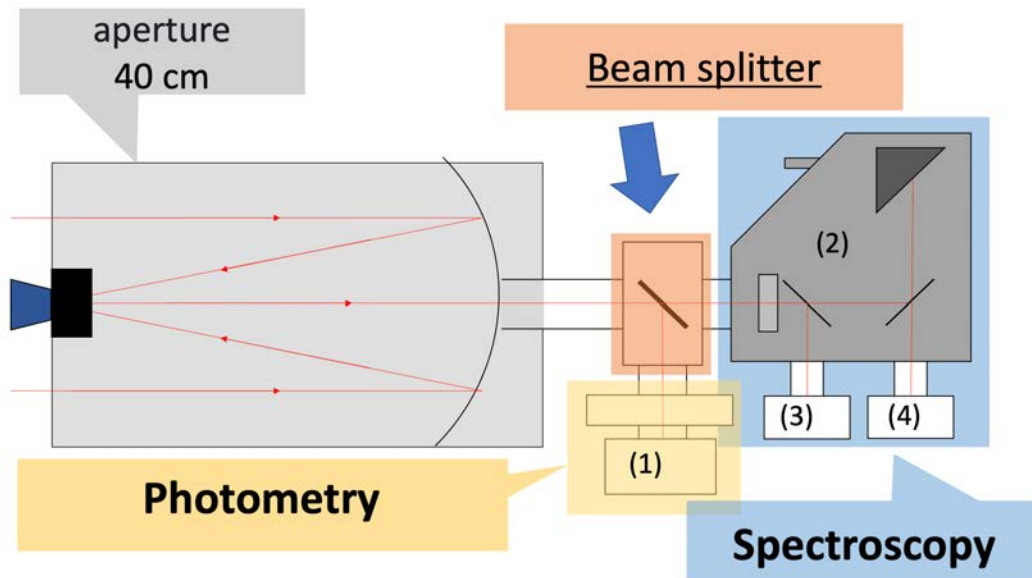


Follow-up observation system of PHAST



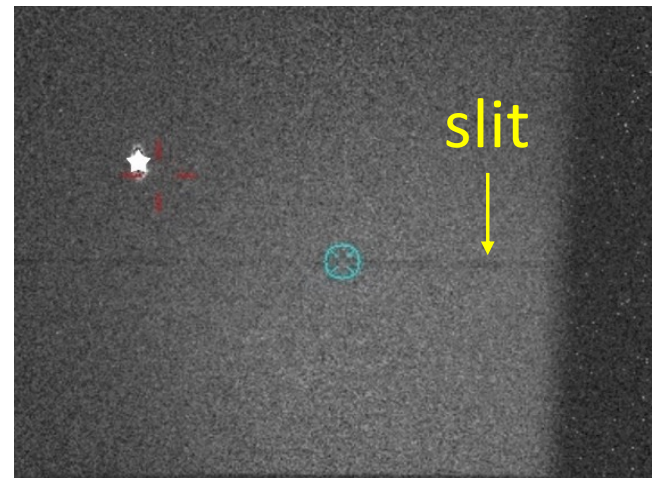
Dome slit setted ! (< 45 sec)

Automatic introducing into the slit



spectroscopic slit (9 arcsec)

movie of autoguide camera (3)

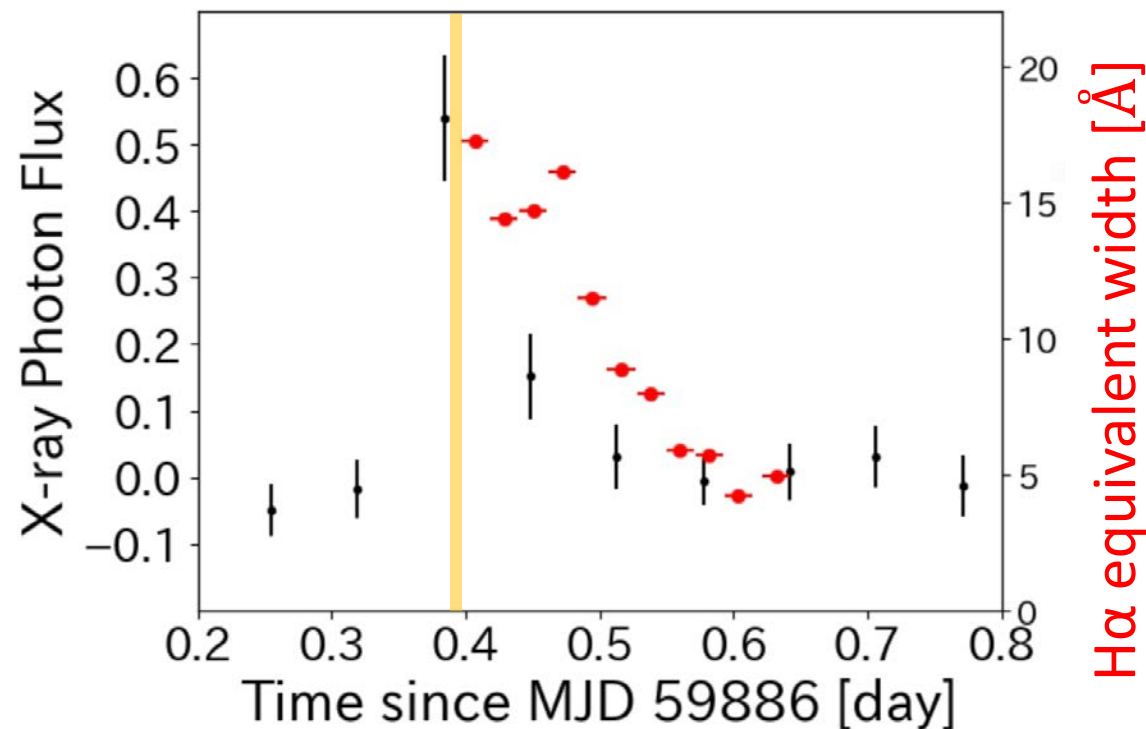


within 60 sec, a target will enter the slit automatically.

A Flare from EQ Peg on 2022 Nov. 3rd

Kohara Master thesis 2022

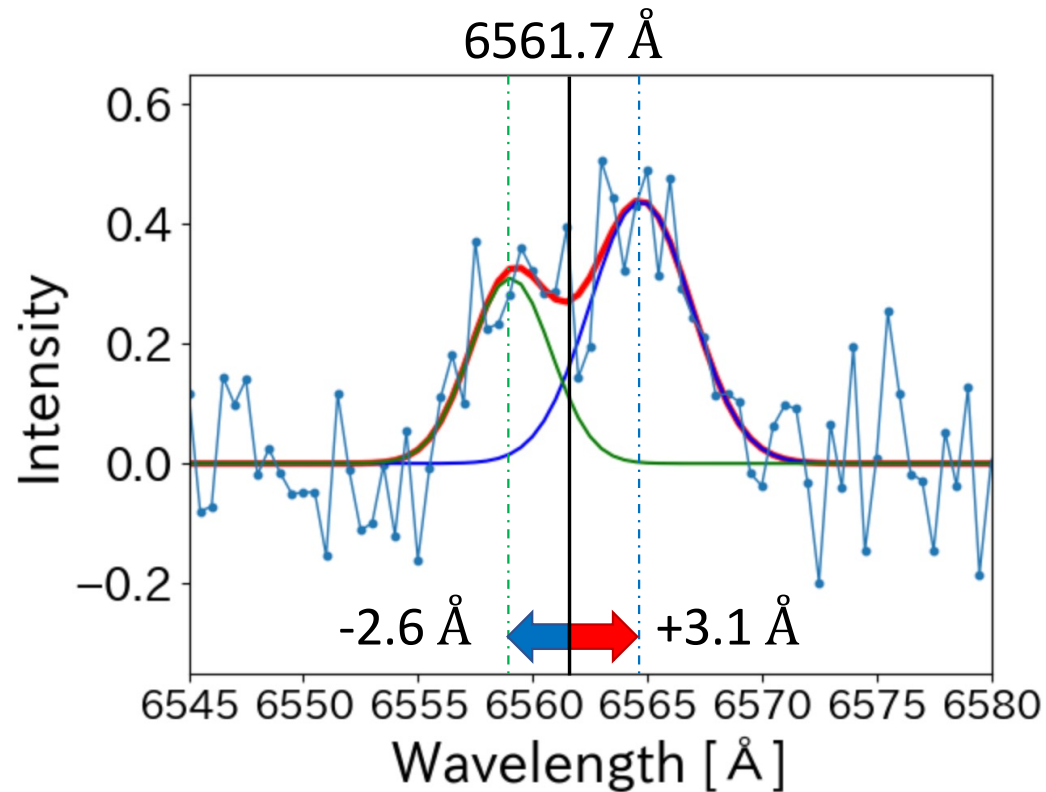
Light curves in the X-ray and H α bands



Follow-up started just 10 min after the MAXI detection

A Flare from II Peg on 2022 Sep. 3rd

Kohara Master thesis 2022



Blue-shift 120 km/s, Red-shift 140 km/s at center of the components

Summary

MAXI:

- MAXI detected > 200 flares from ~ 30 stars in 15 years
- Huge flaring loops are suggested for MAXI flares.

MAXI + CHAO:

- Sample of extreme scales of doppler shift components have been accumulated. \rightarrow huge amounts of ejection?
- Time-resolved spectra can be obtained with follow-up of MAXI flares. \rightarrow We can track plasma geometry changes.