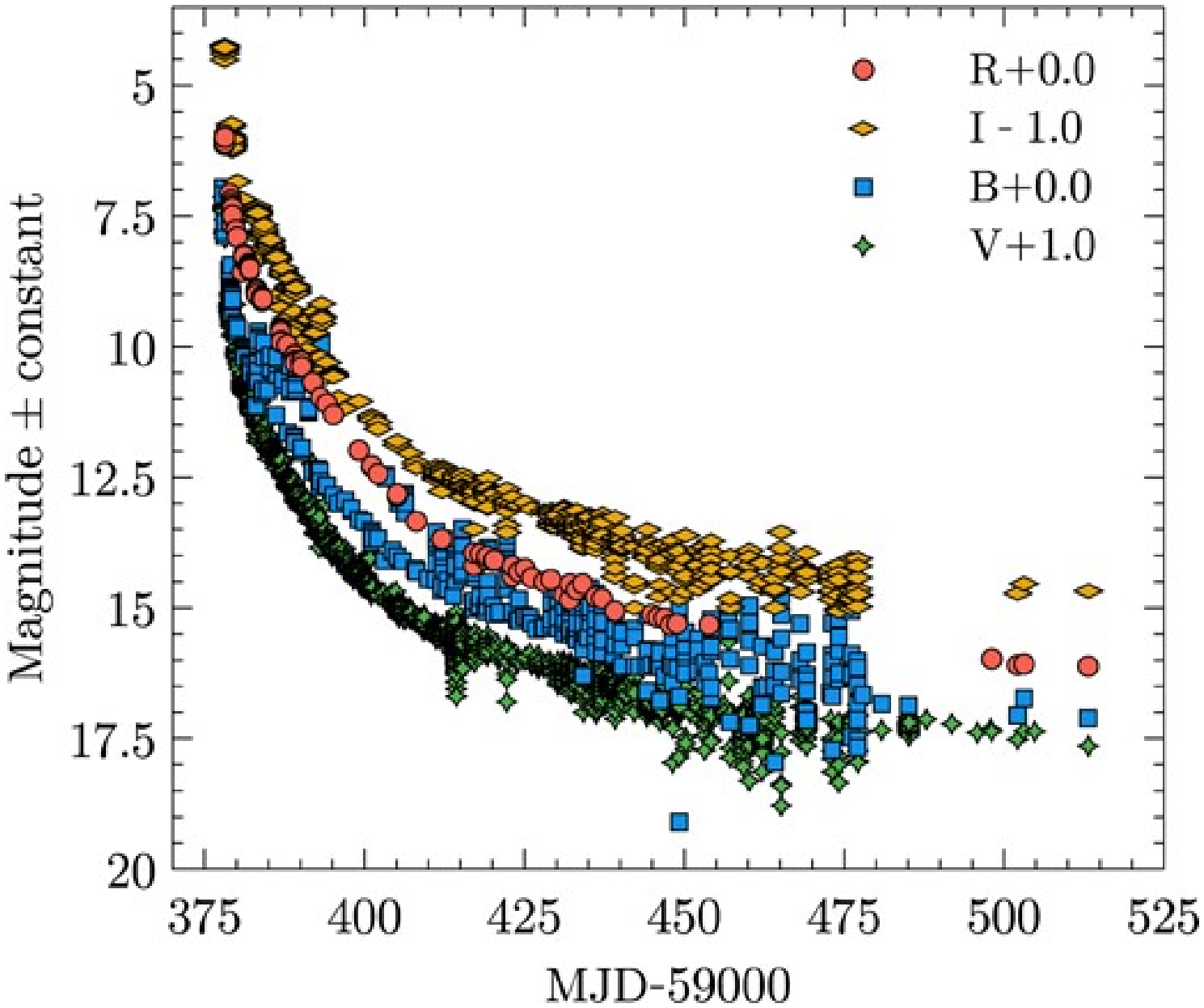
Short bursts in cataclysmic variables with TESS and Kepler

Krystian Iłkiewicz

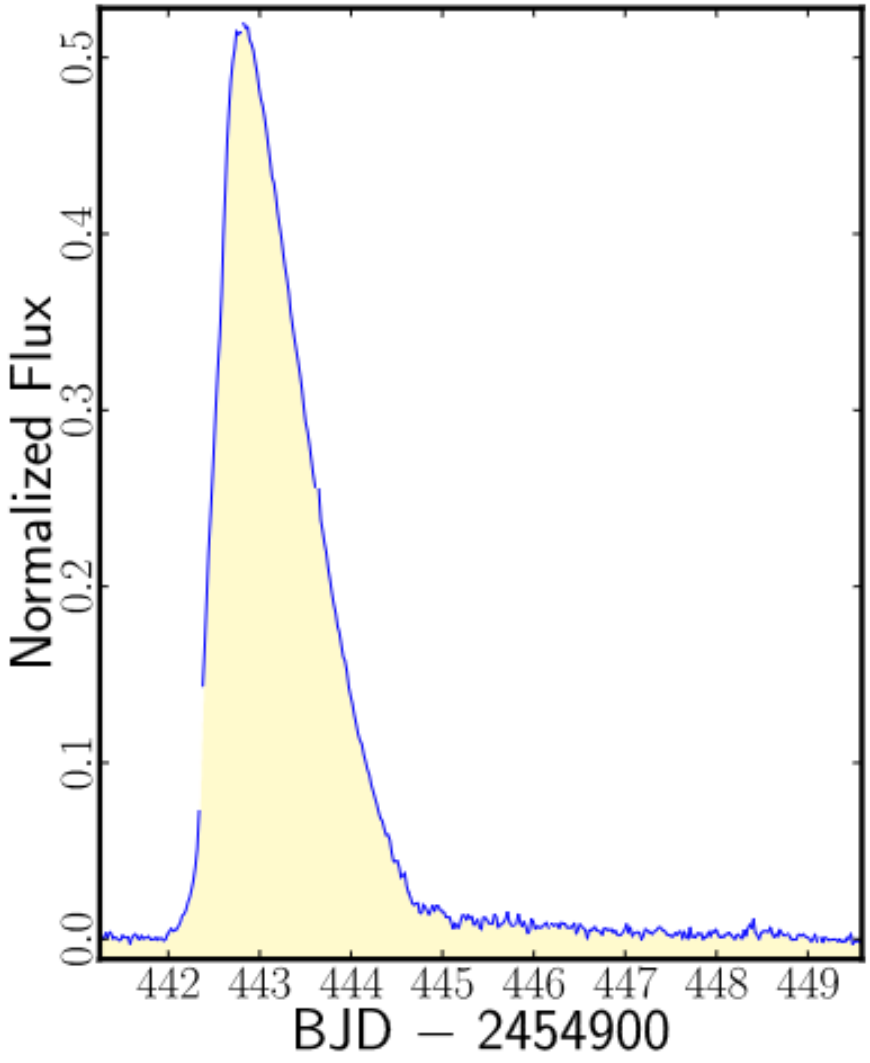
06.06.2024

Classical novae



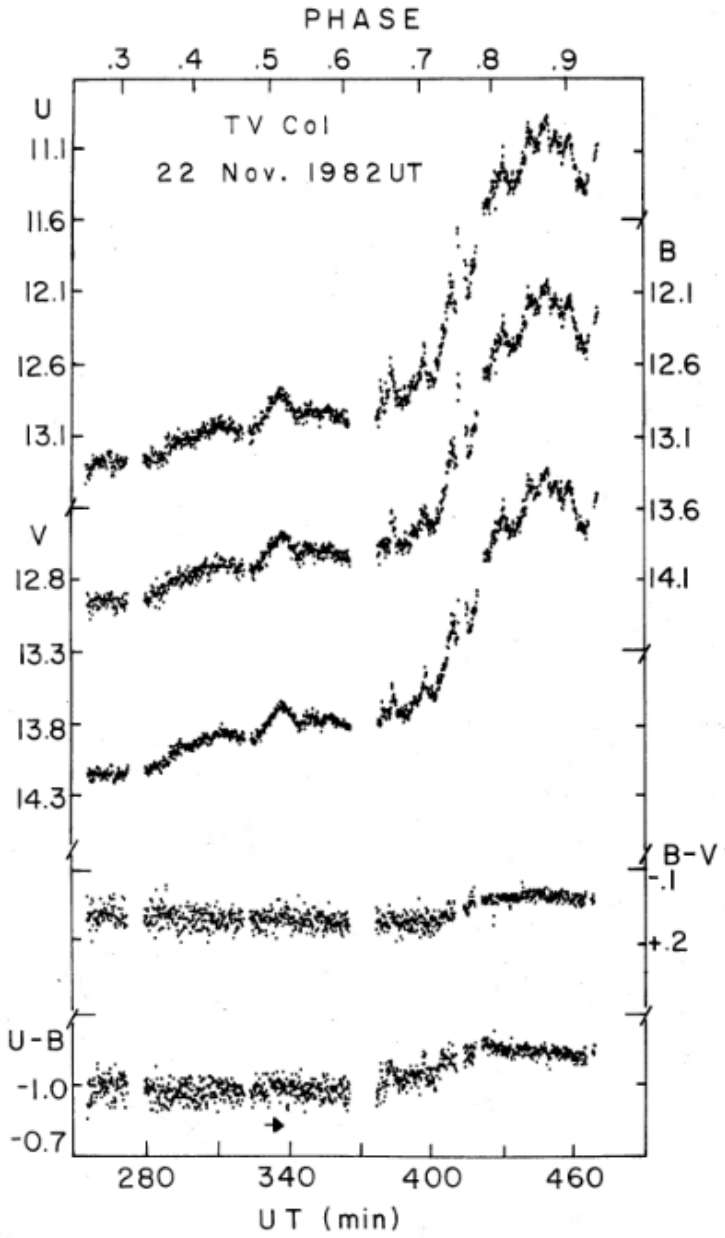
Habtie et al. (2023)

Dwarf novae



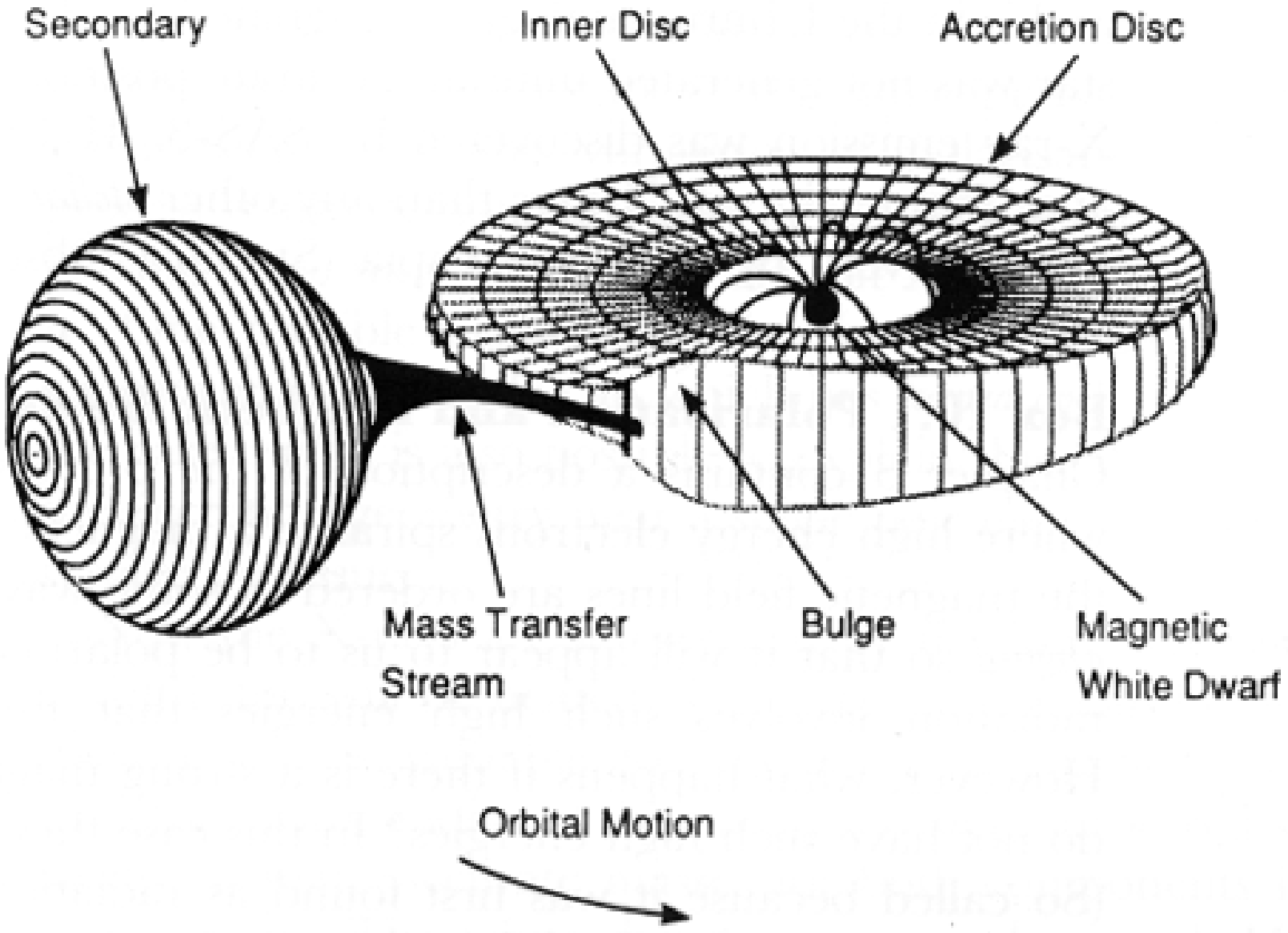
Barclay et al. (2012)

Flares in intermediate polars



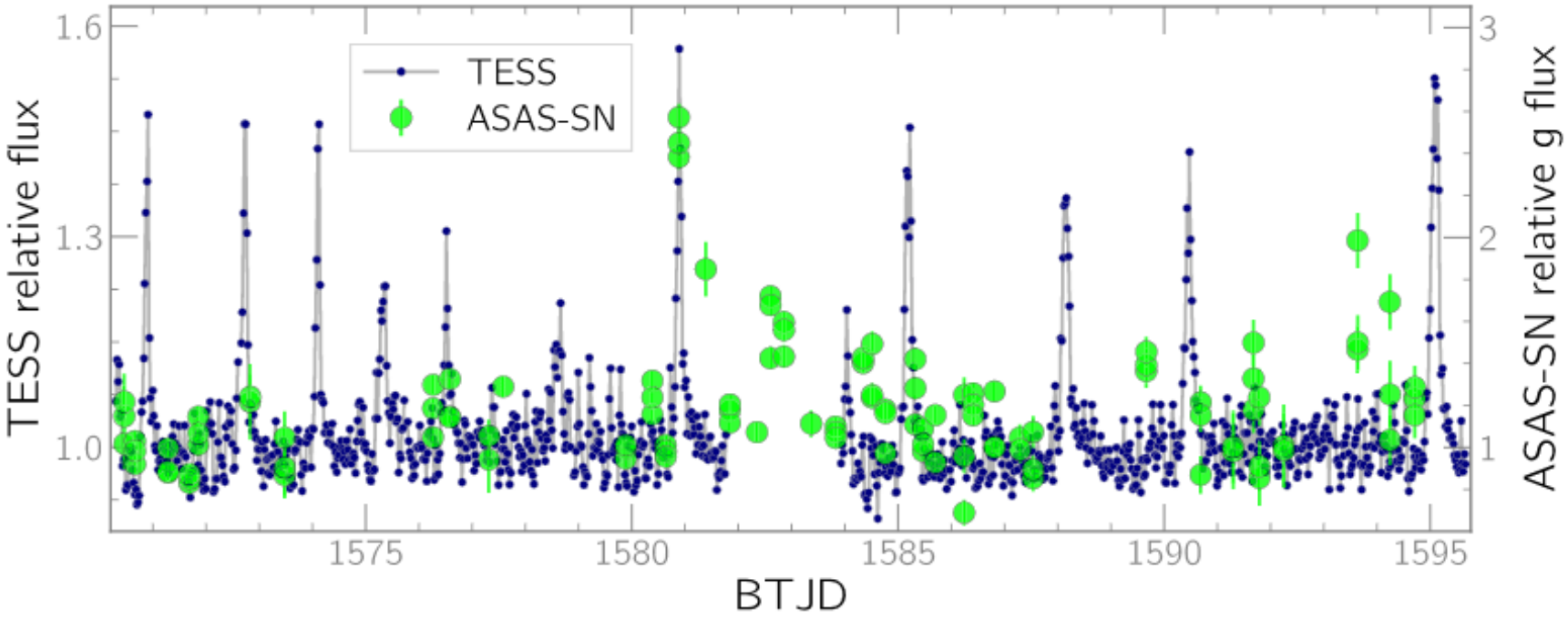
Szkody & Mateo (1984)

Intermediate polars



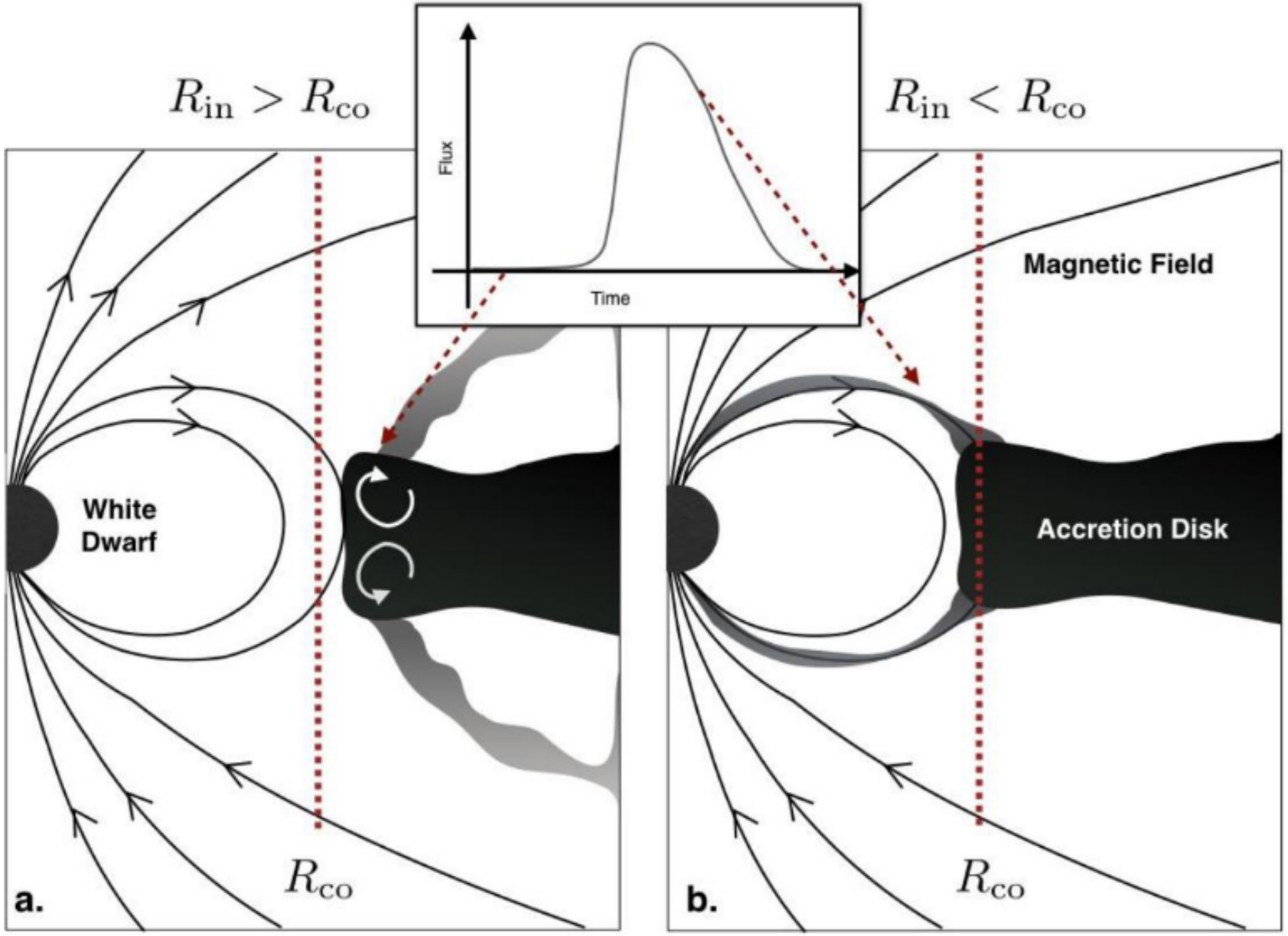
Hameury & Lasota (2017) - dwarf nova outbursts in intermediate polars are unlikely

Magnetic gating



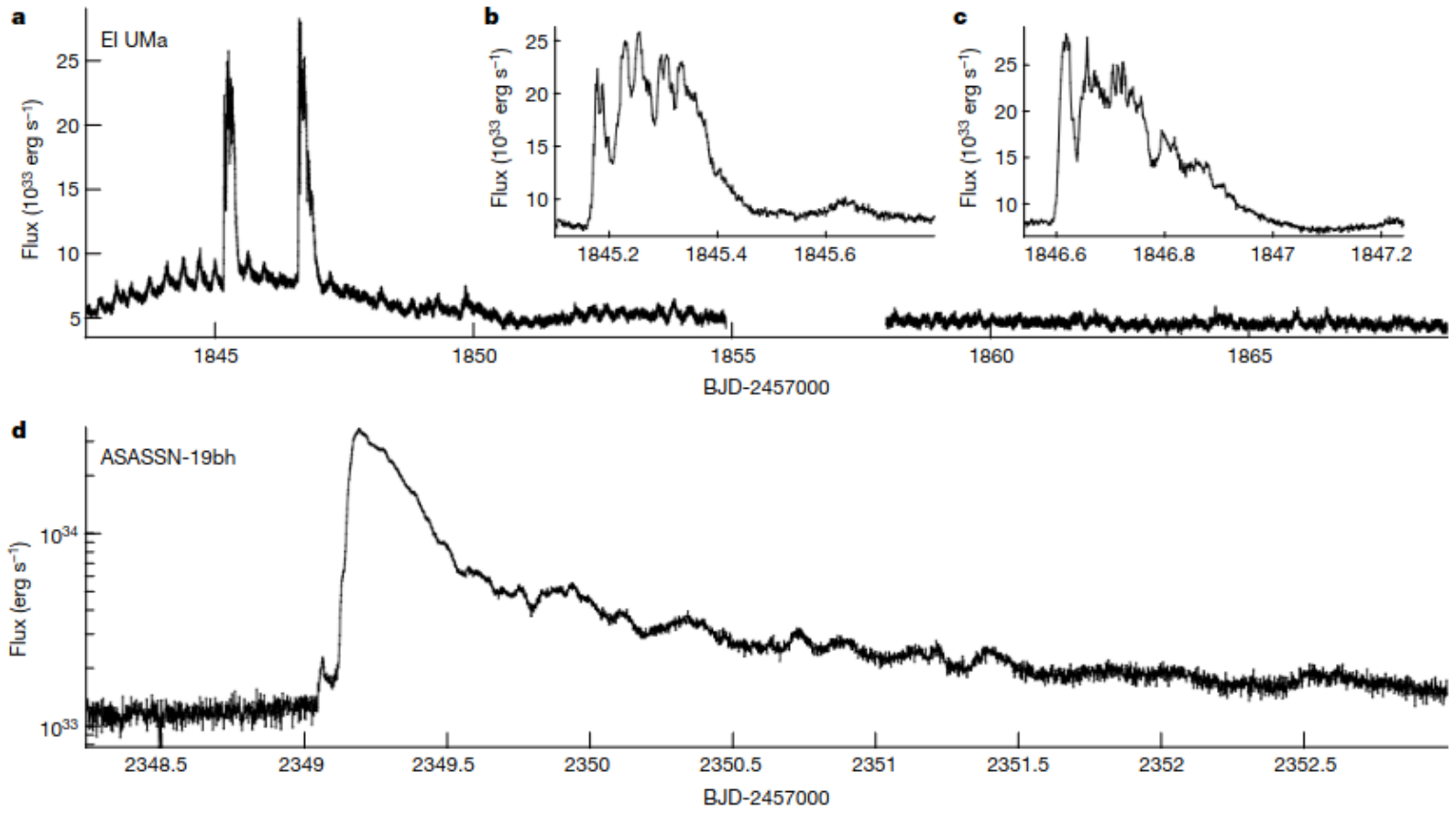
Littlefield et al. (2022)

Magnetic gating

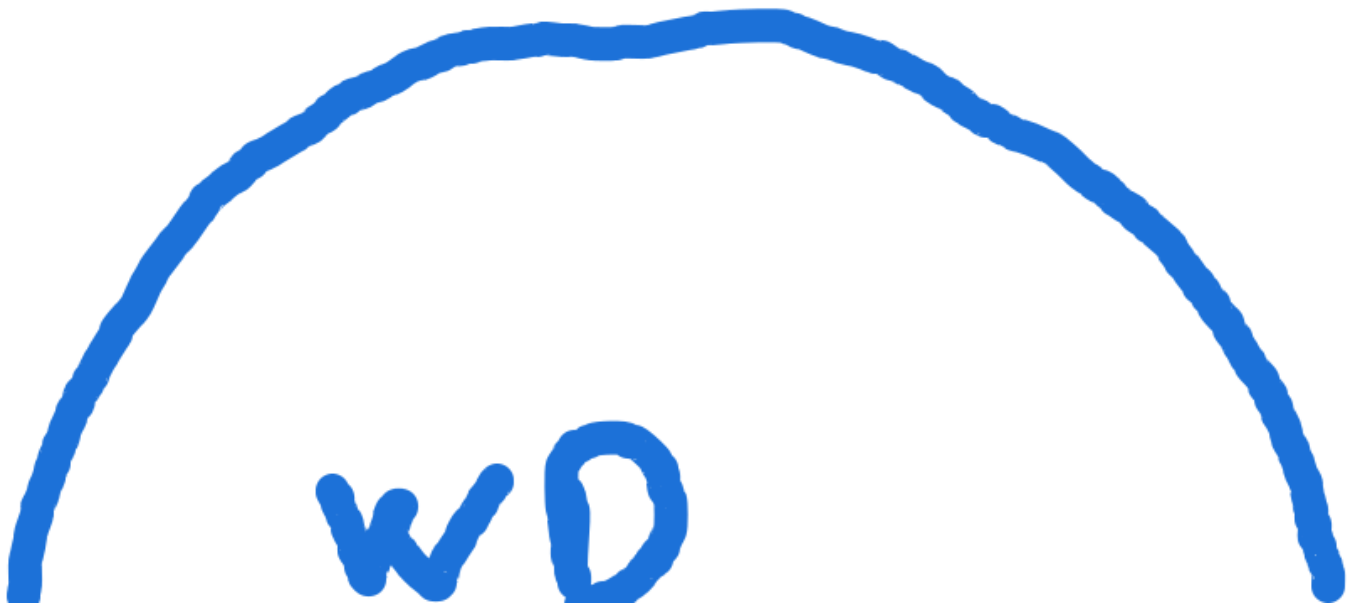


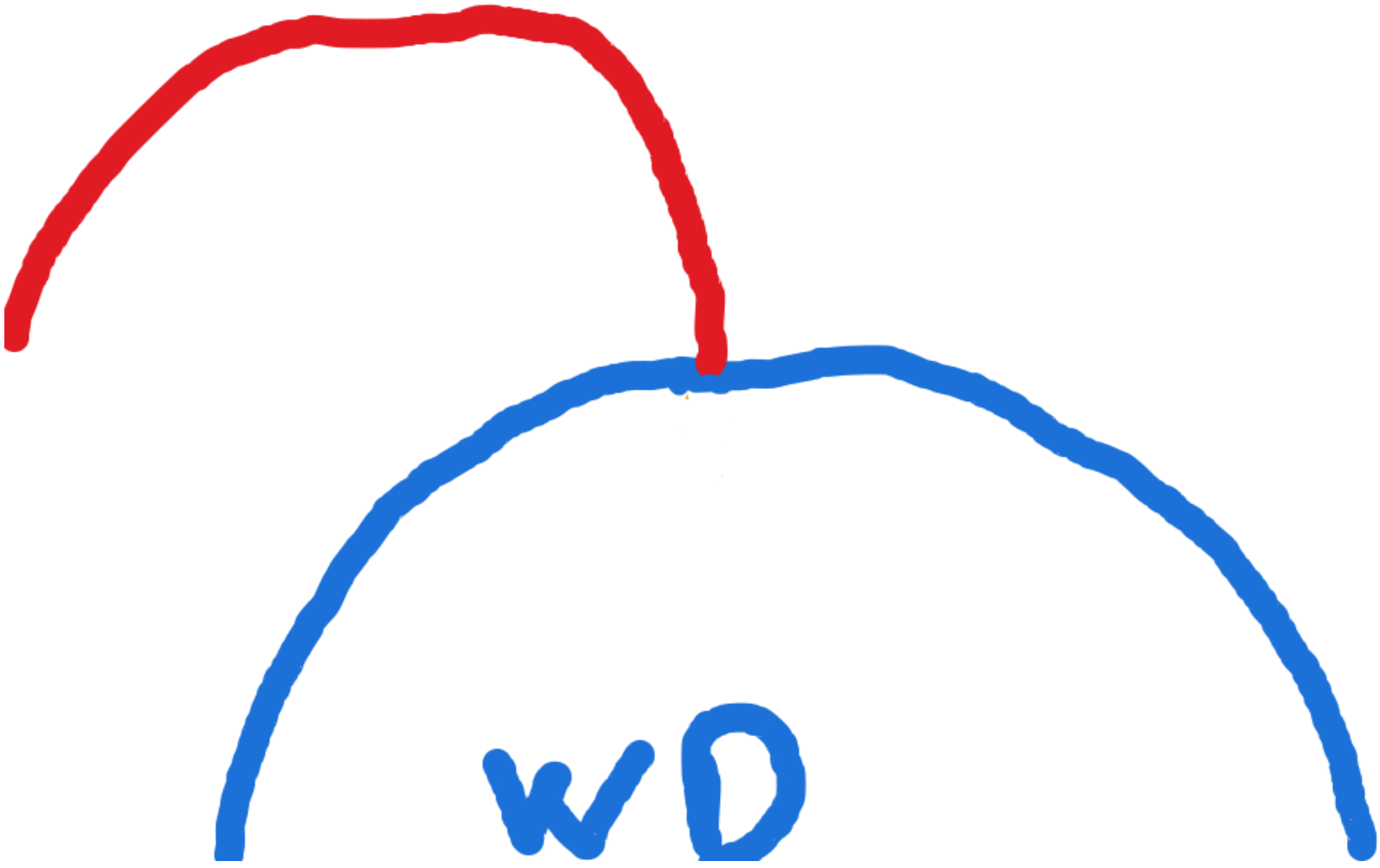
Scaringi et al. (2017)

Micronovae



Scaringi et al. (2022)


wD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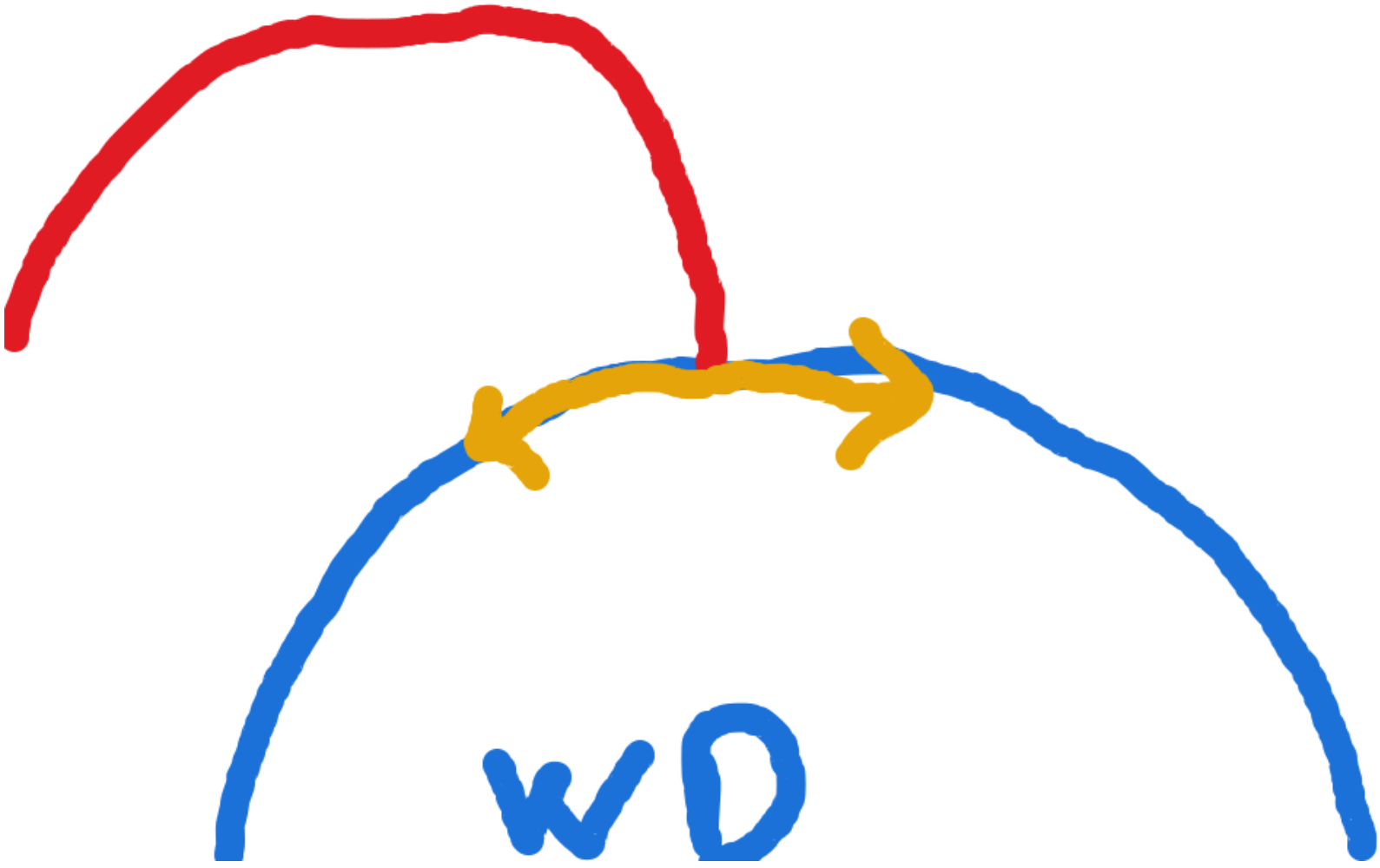
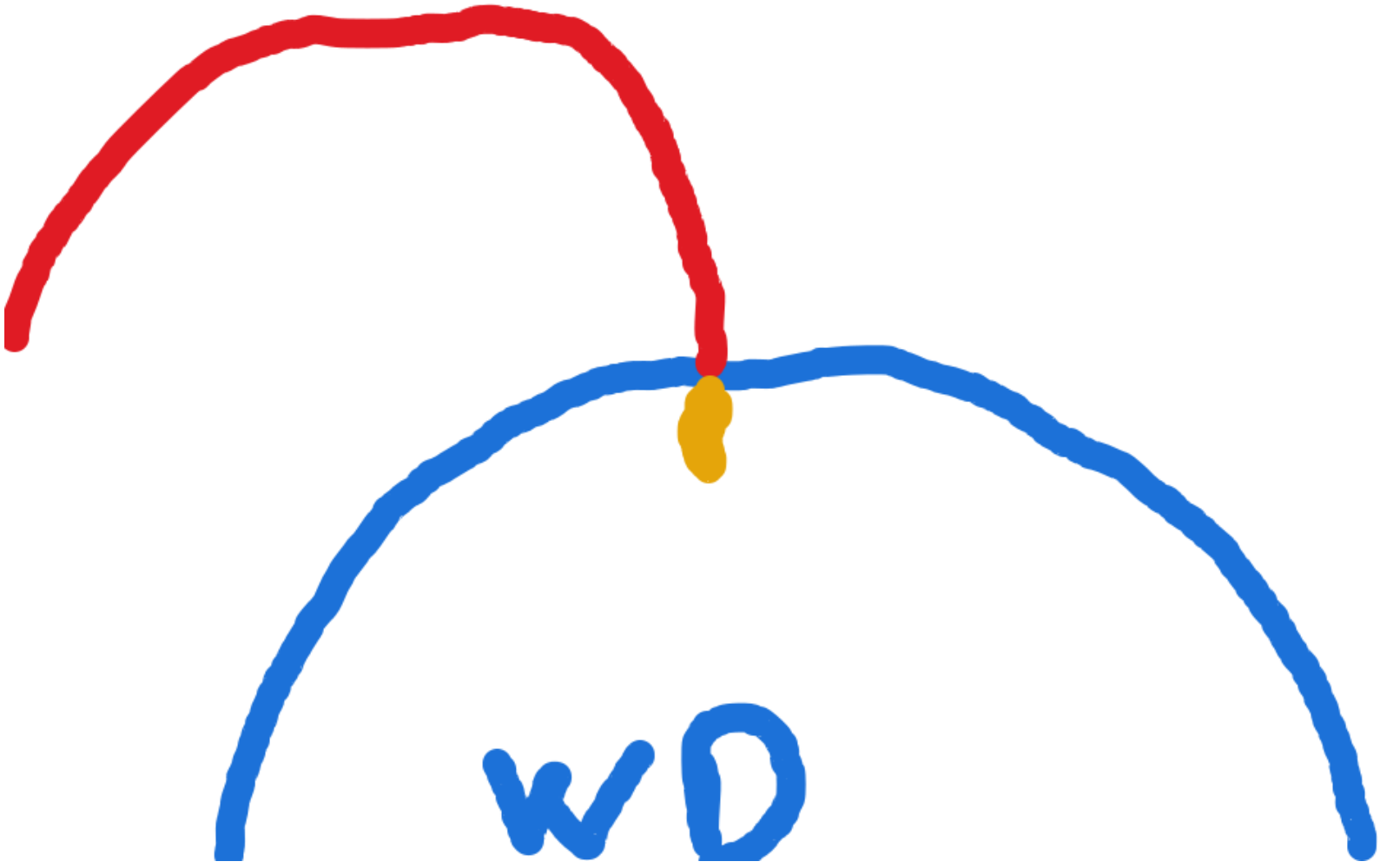

wD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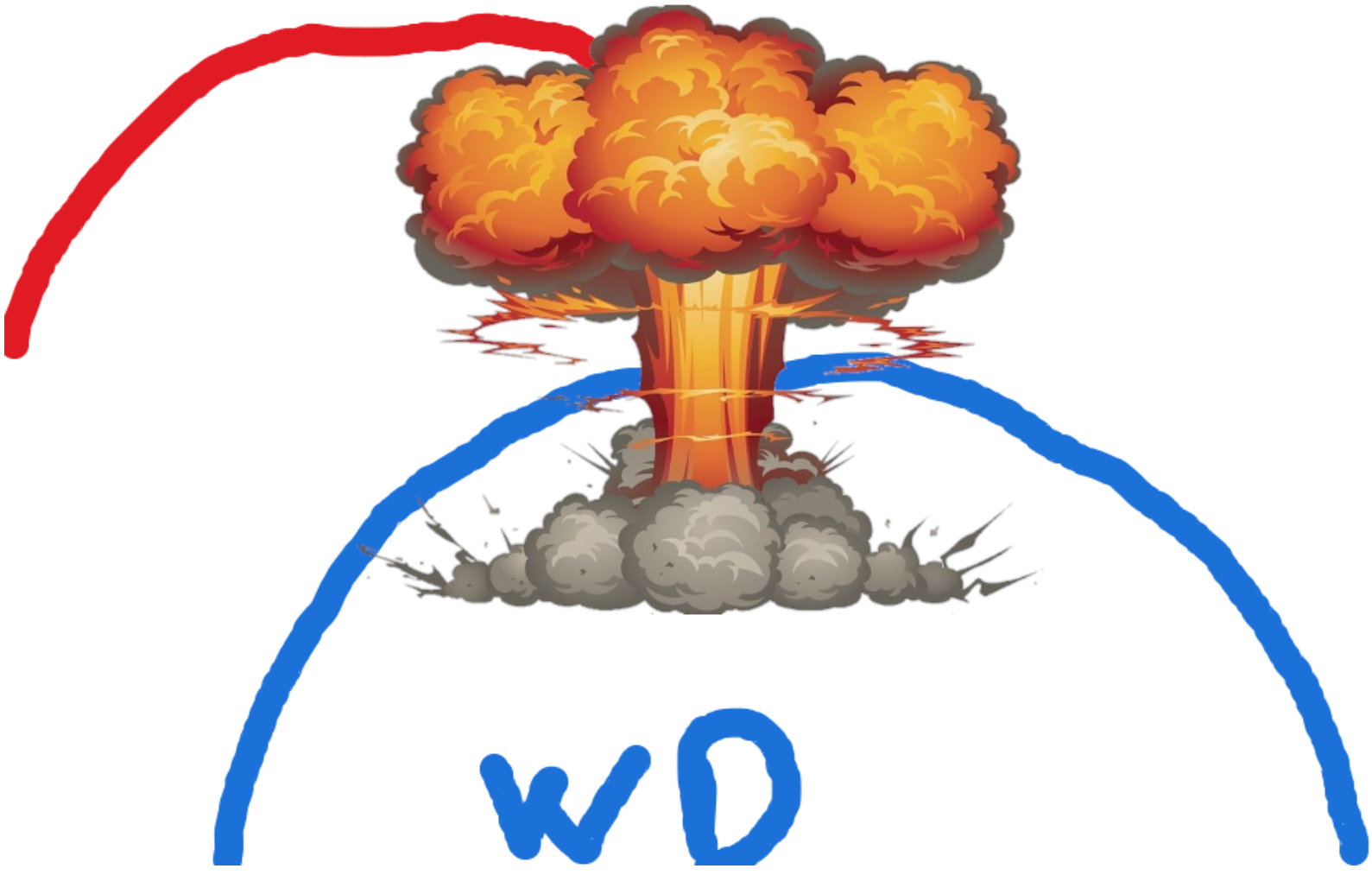
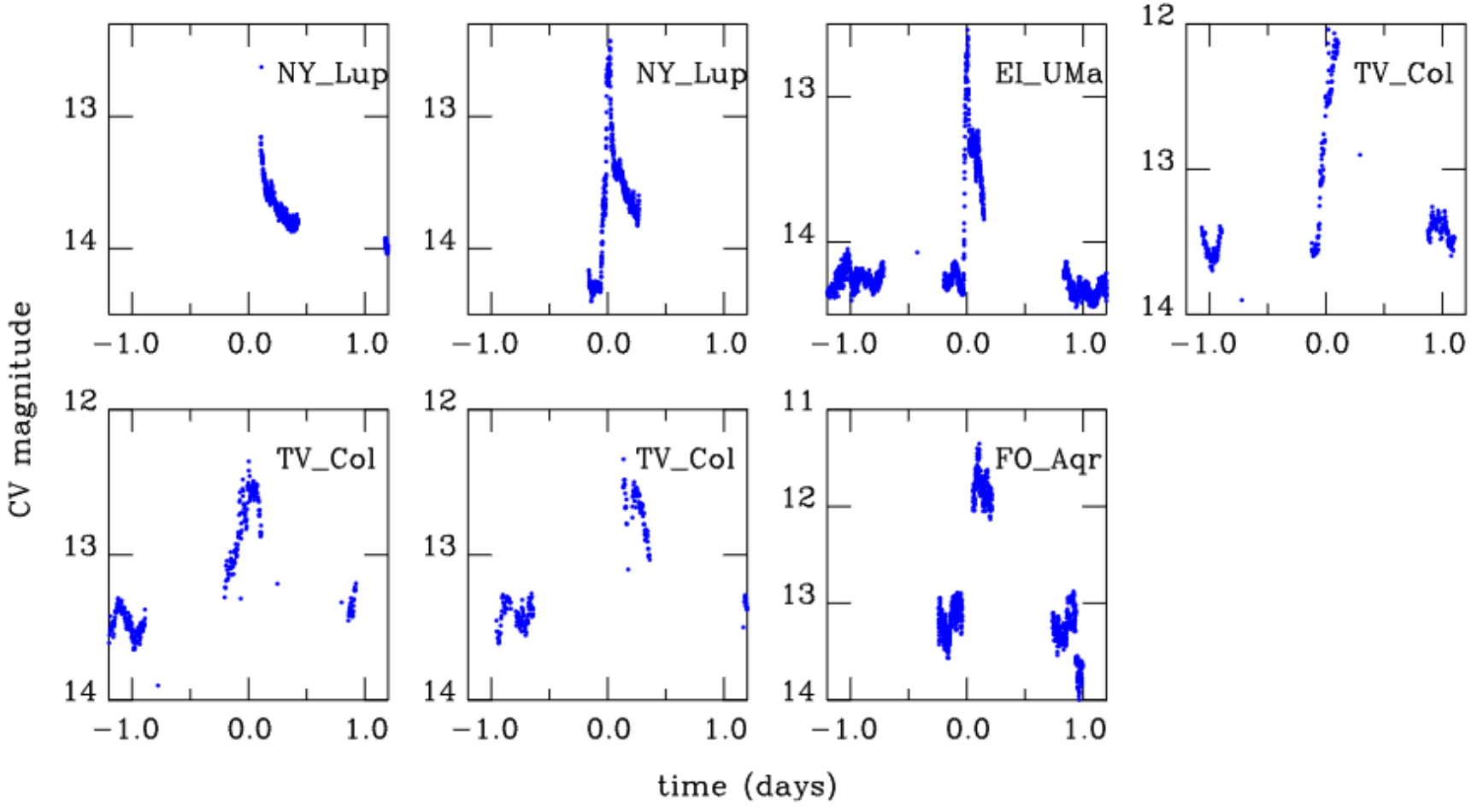

wD

Magnetic gating after all?



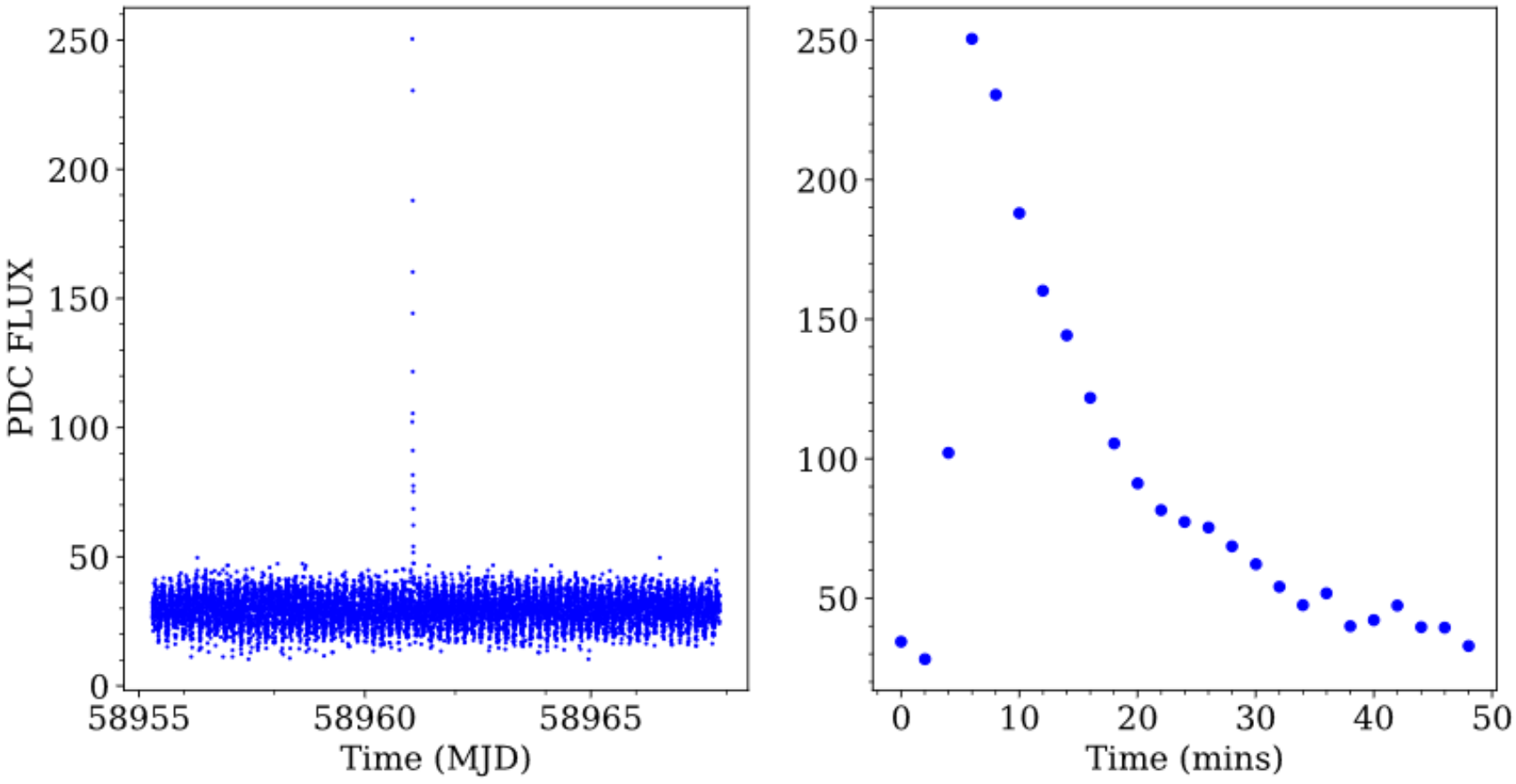
Hameury et al. (2022)

Donor flares

Donor flares

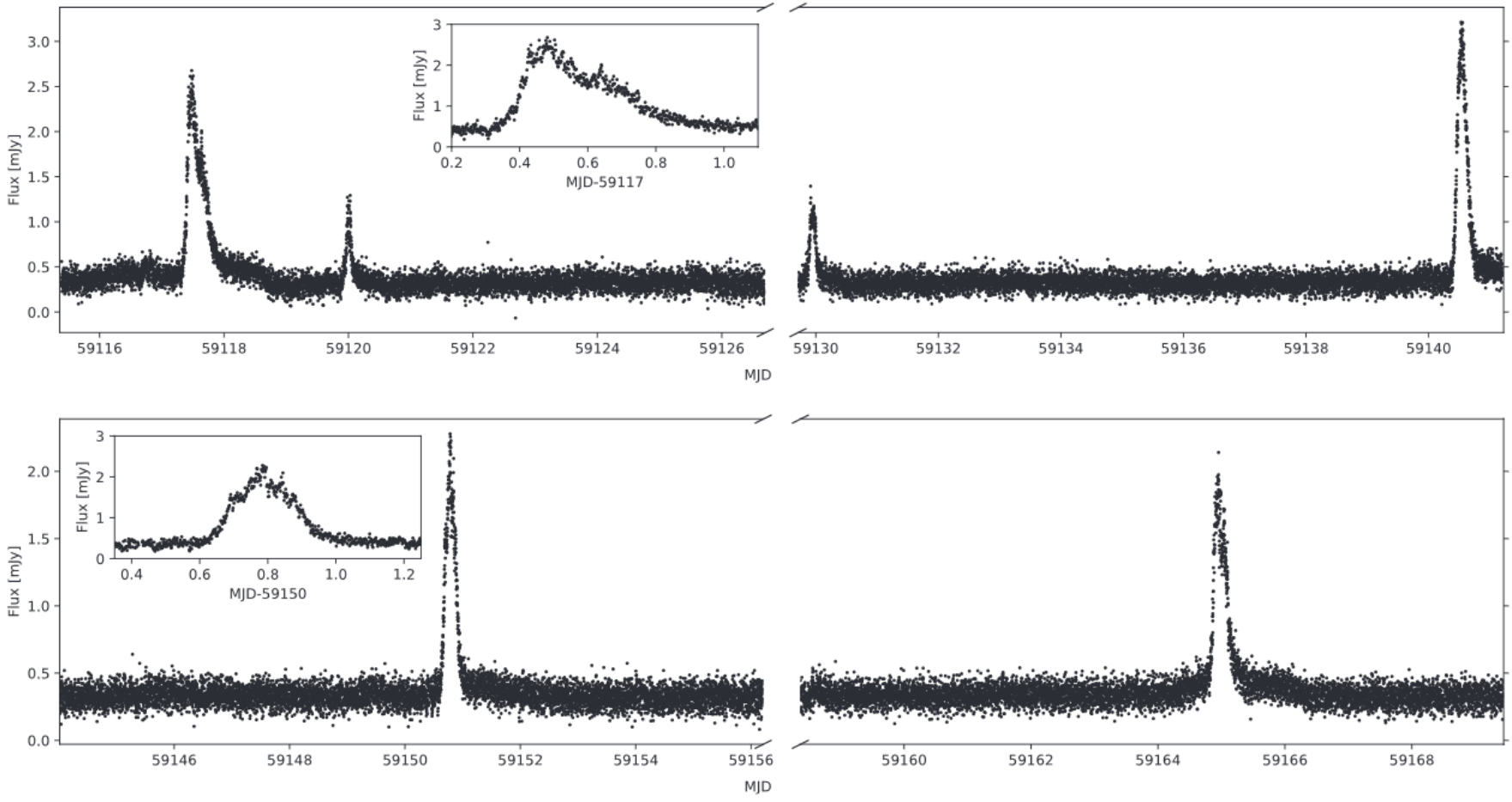
Unlikely in cataclysmic variables (Gunther et al. 2020; Ramsey et al. 2020)

Donor flare in MQ Dra



Ramsay et al. (2021)

Bursts in J0333



Short bursts in cataclysmic variables

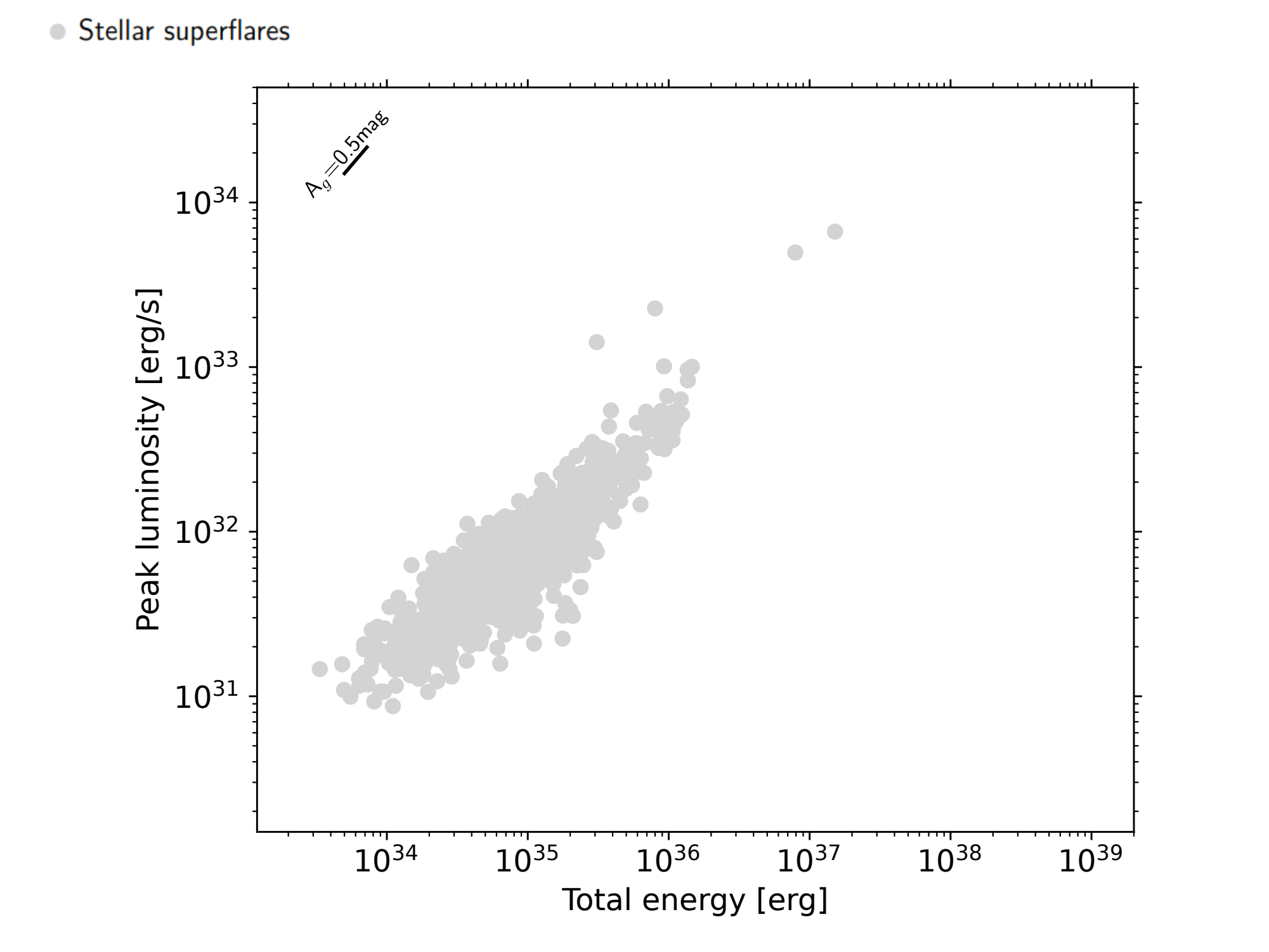
Dwarf nova?

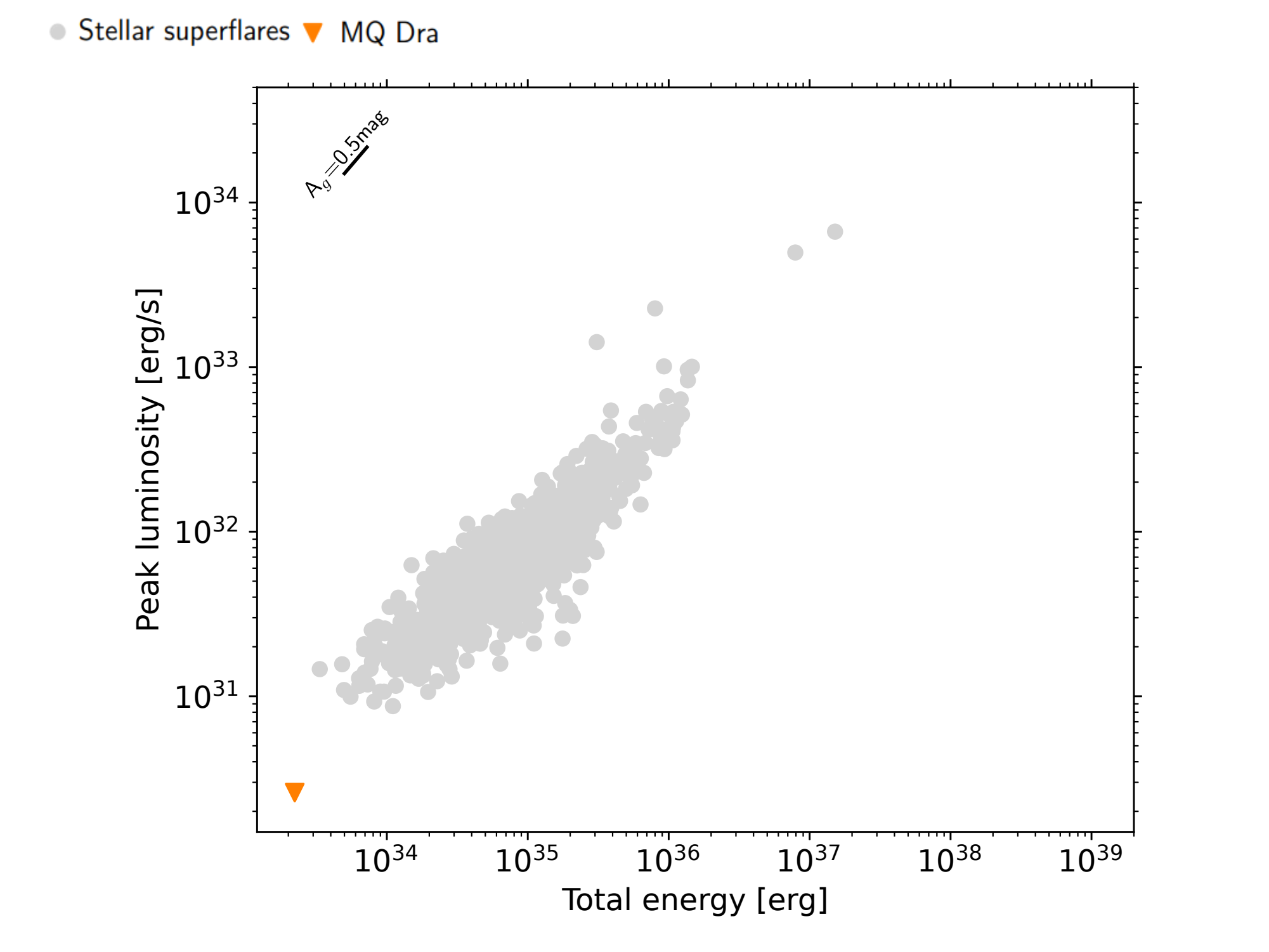
Magnetic gating?

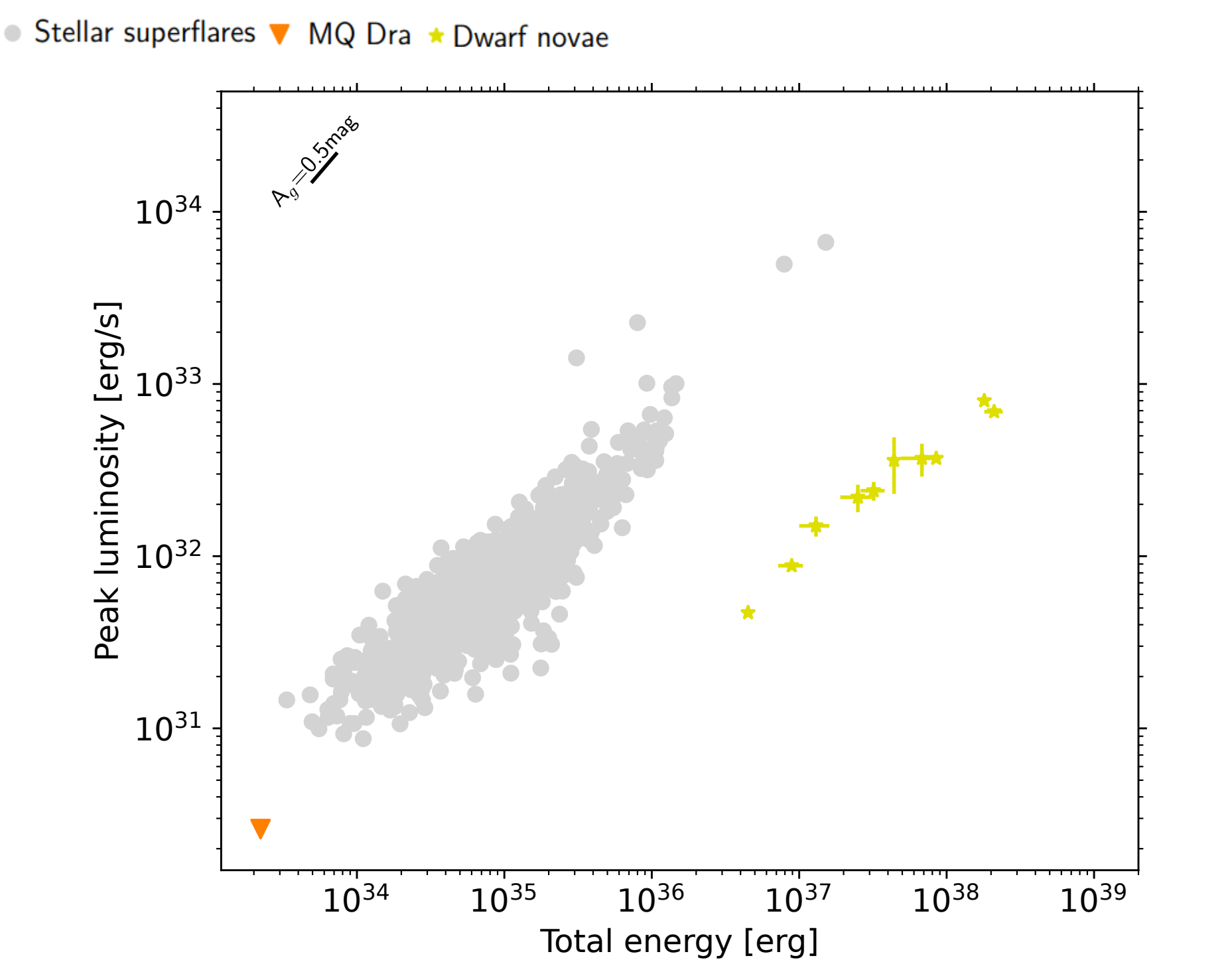
Micronova?

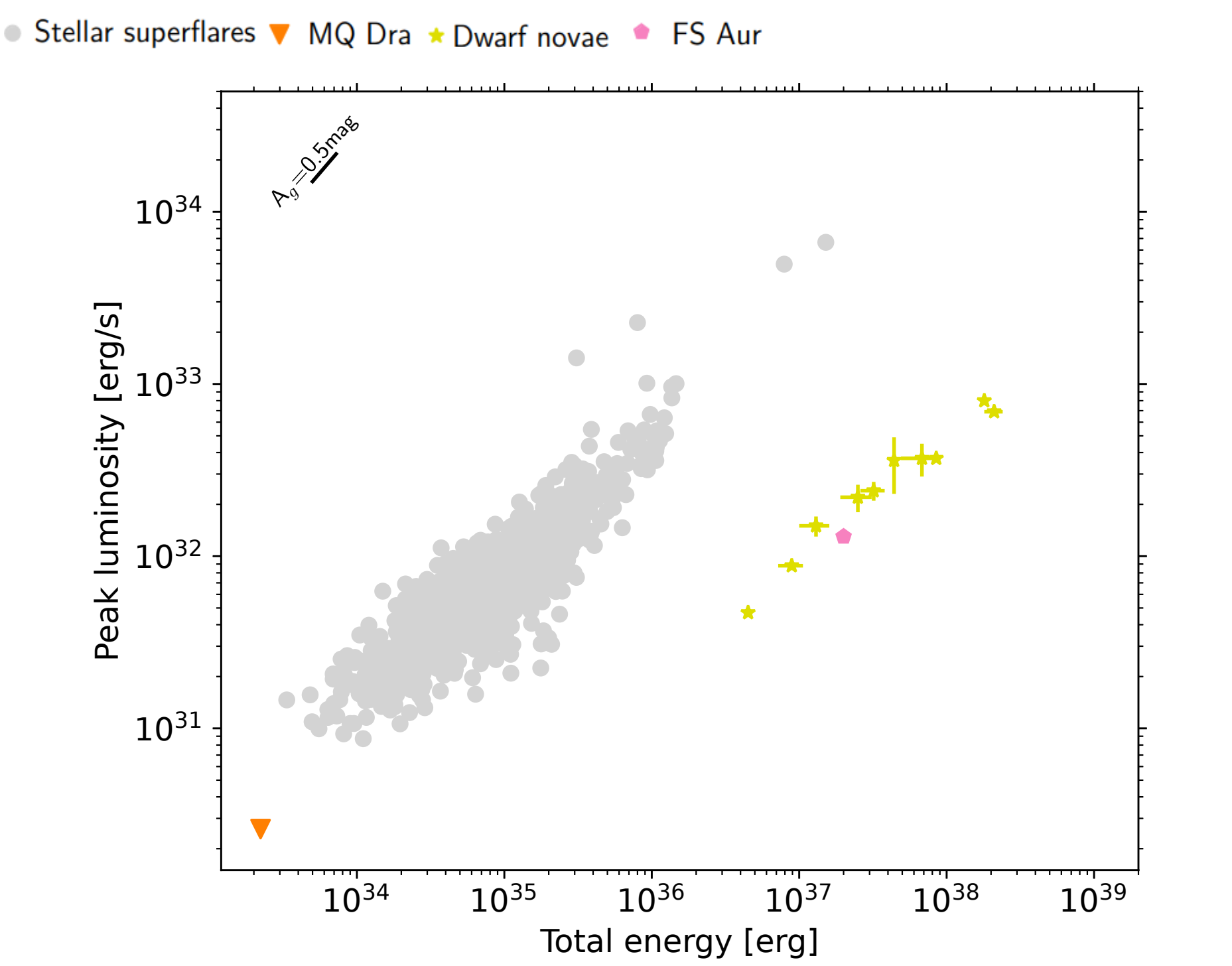
Donor flare?

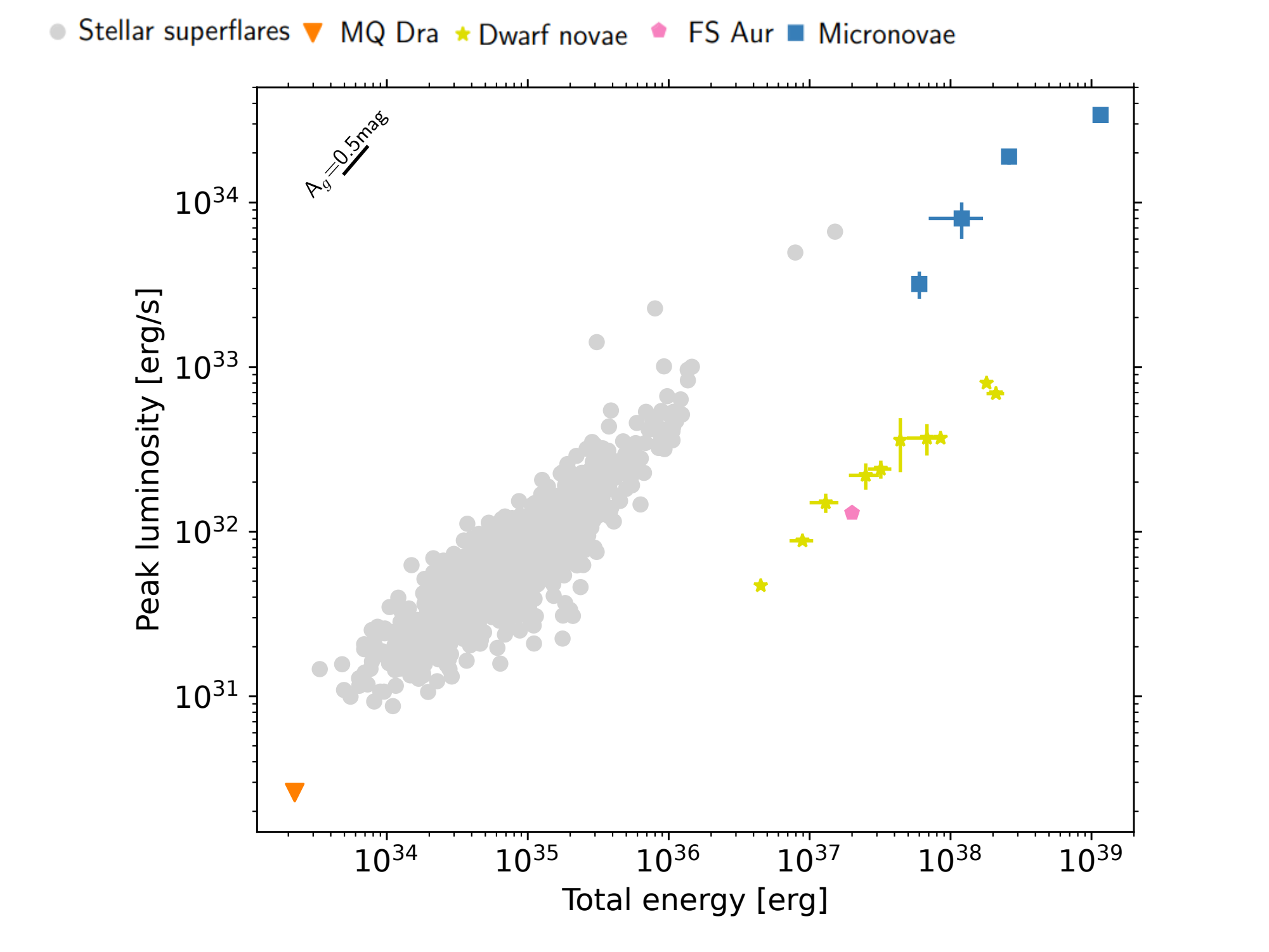
Population of **short** (out)bursts observed by TESS and Kepler

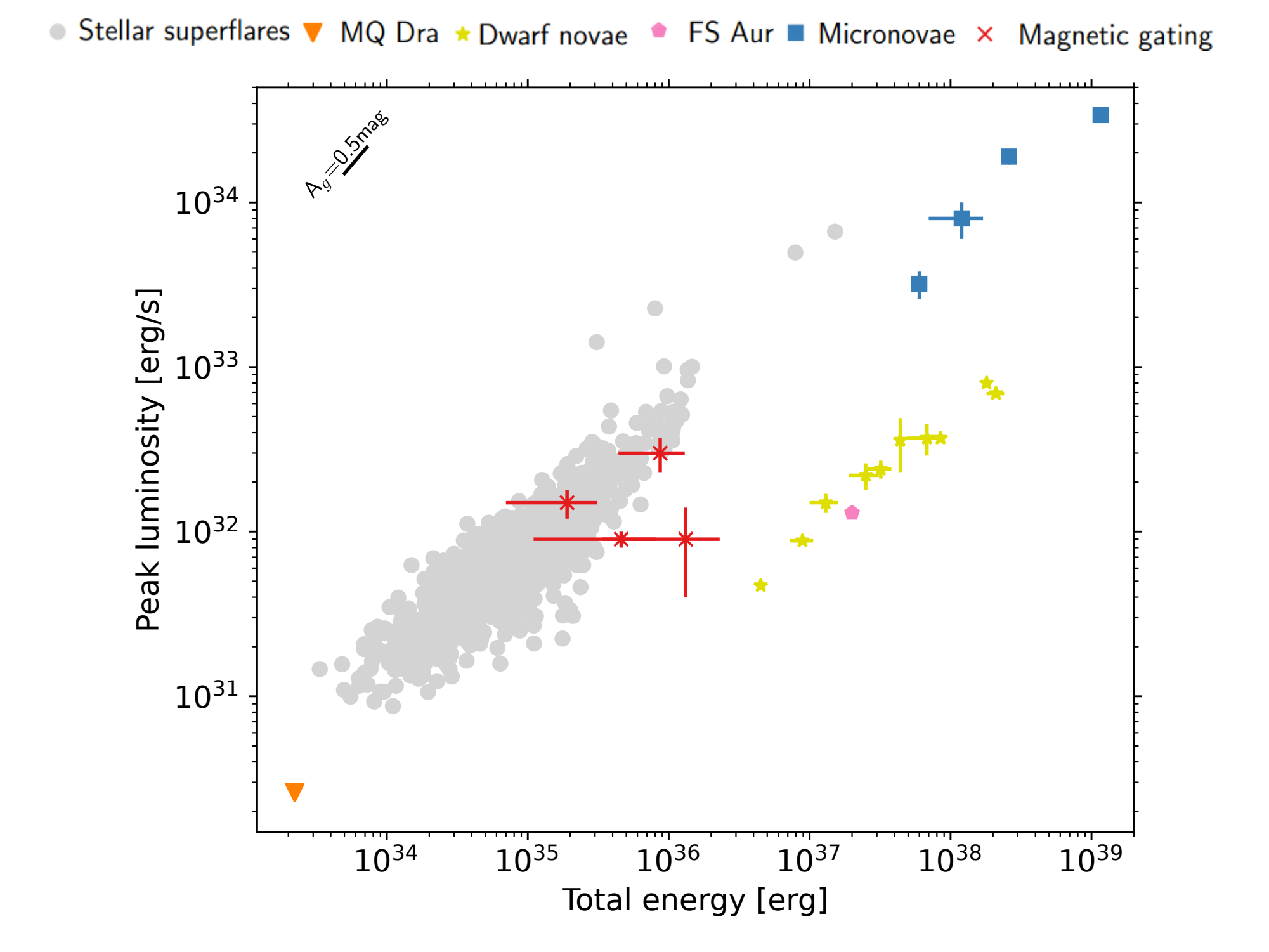

Stellar superflares
A_g=0.5mag
Peak luminosity [erg/s]
10^{34}
10^{33}
10^{32}
10^{31}
10^{34}
10^{35}
10^{36}
10^{37}
10^{38}
10^{39}
Total energy [erg]

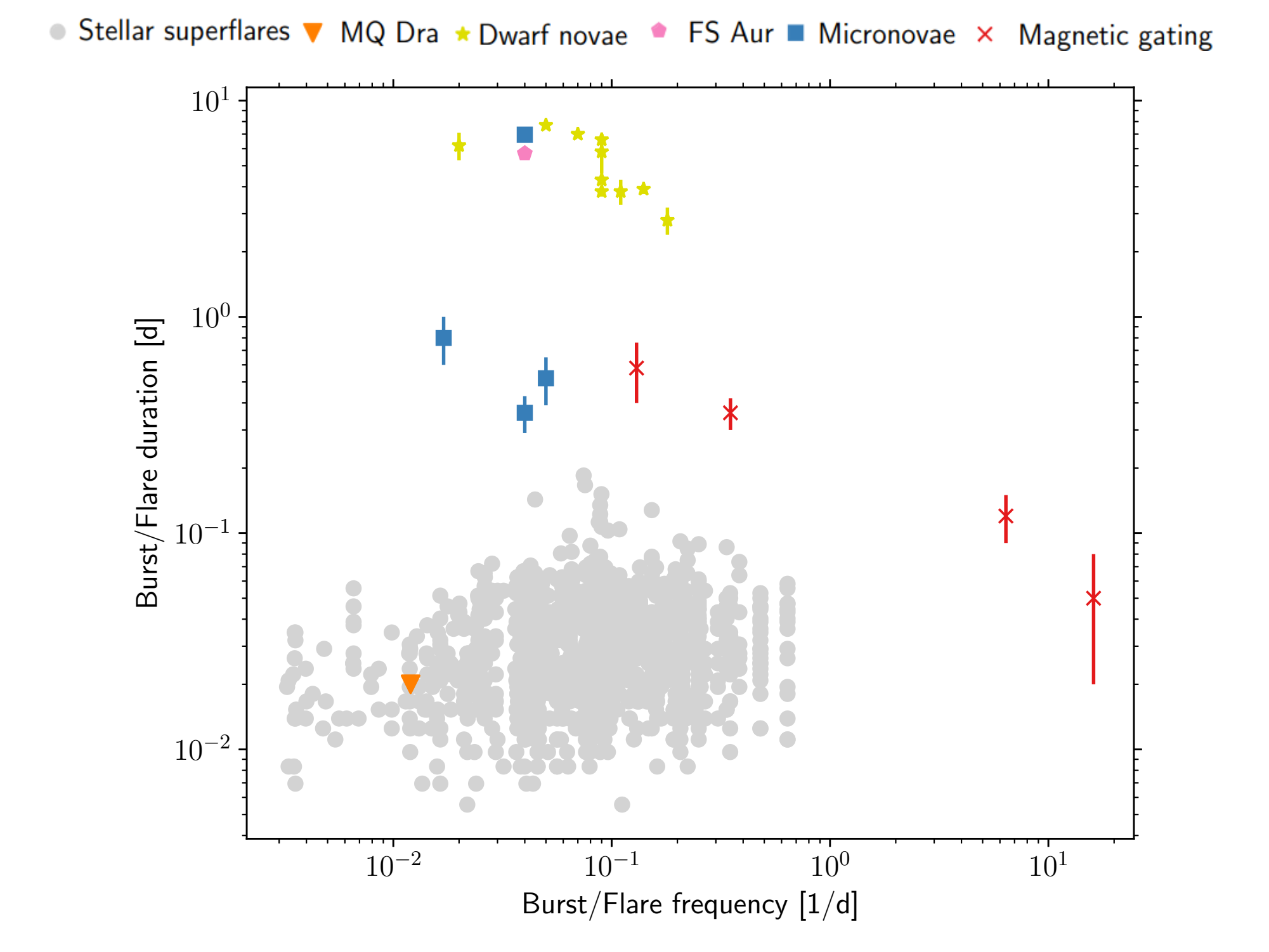

Stellar superflares
MQ Dra
A_g=0.5mag
Peak luminosity [erg/s]
10^{34}
10^{33}
10^{32}
10^{31}
10^{34}
10^{35}
10^{36}
10^{37}
10^{38}
10^{39}
Total energy [erg]

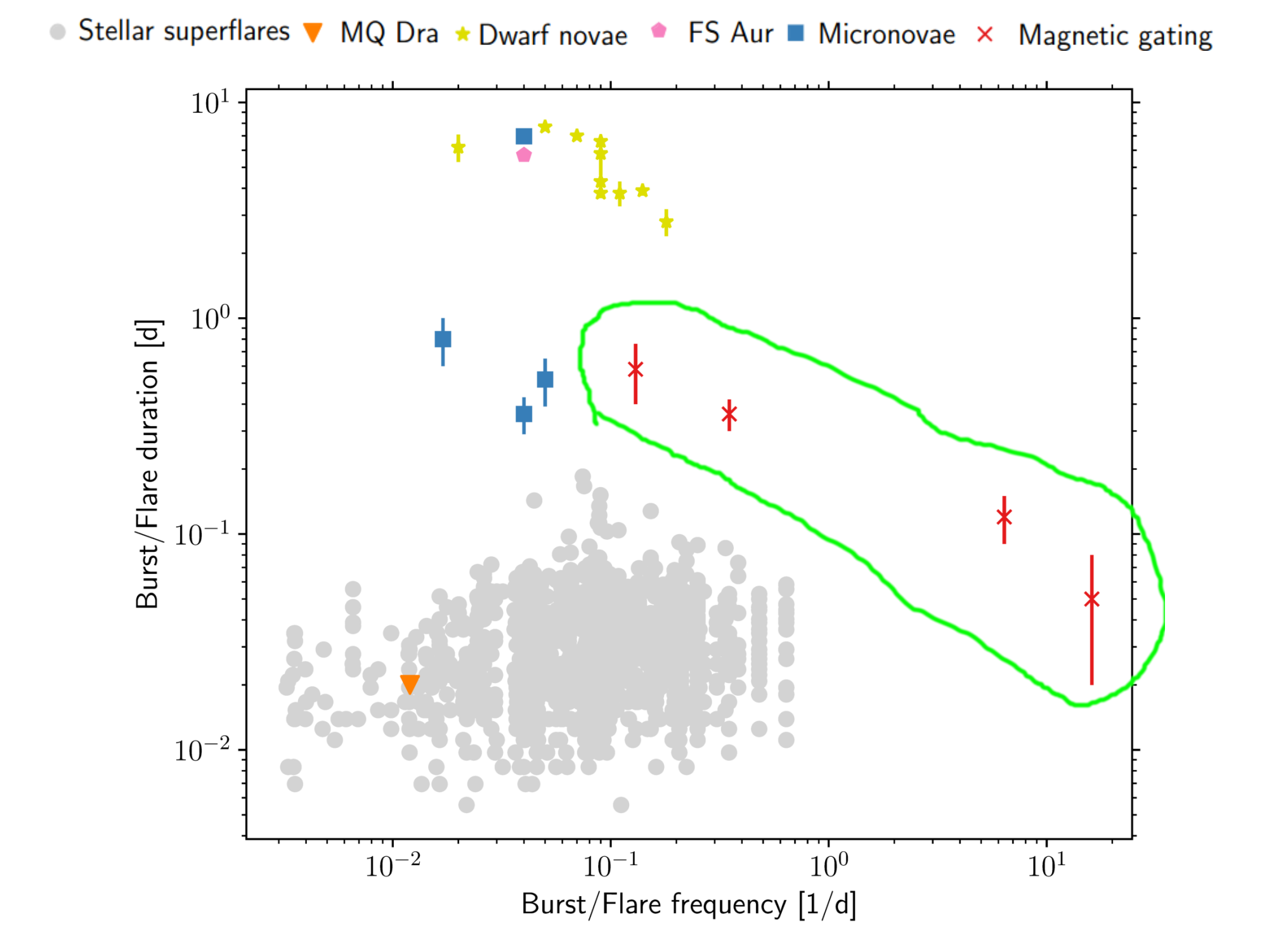

Stellar superflares
MQ Dra
Dwarf novae
A_g=0.5mag
Peak luminosity [erg/s]
10^{34}
10^{33}
10^{32}
10^{31}
10^{34}
10^{35}
10^{36}
10^{37}
10^{38}
10^{39}
Total energy [erg]

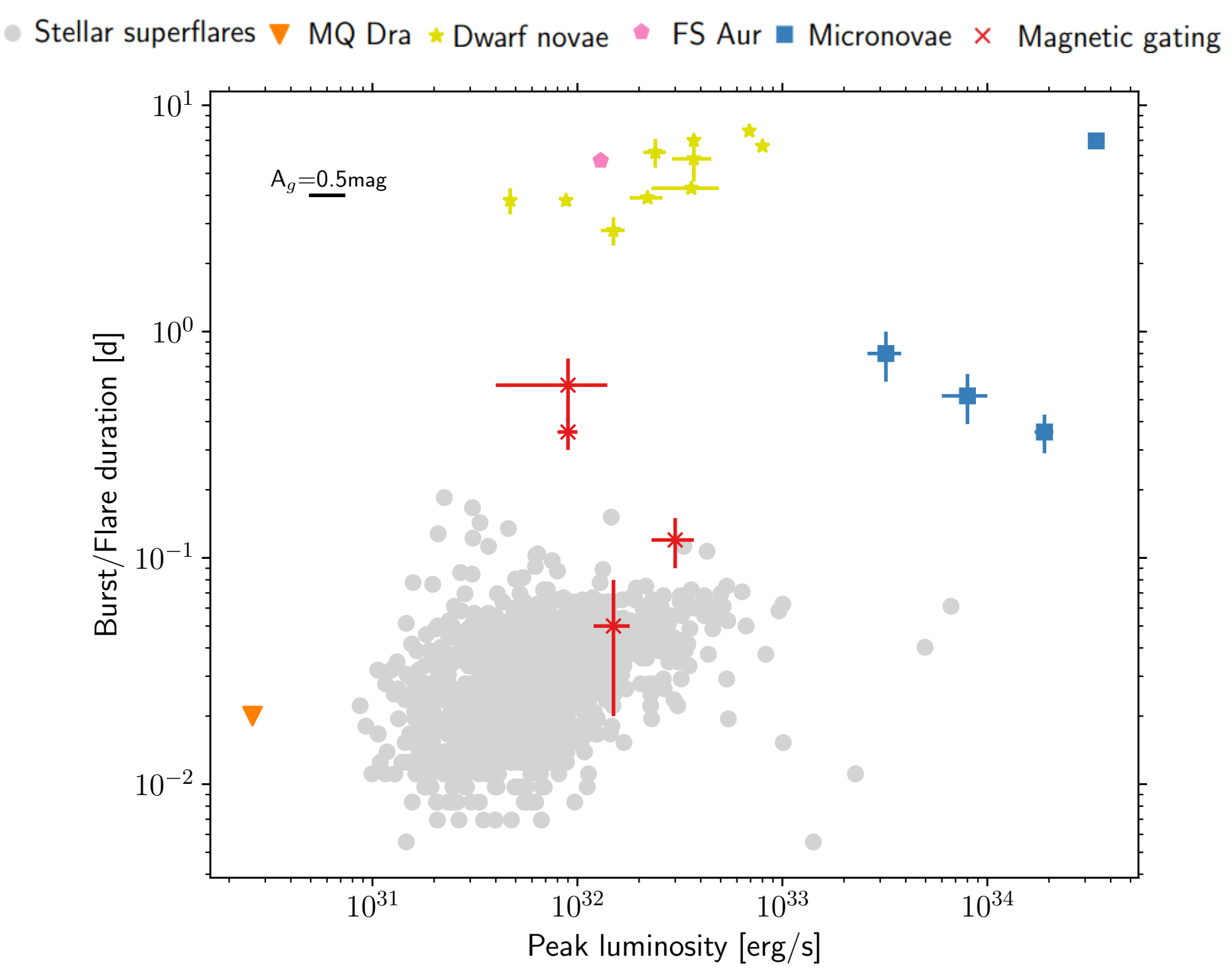

Stellar superflares
MQ Dra
Dwarf novae
FS Aur
A_g=0.5mag
Peak luminosity [erg/s]
10^{34}
10^{33}
10^{32}
10^{31}
10^{34}
10^{35}
10^{36}
10^{37}
10^{38}
10^{39}
Total energy [erg]

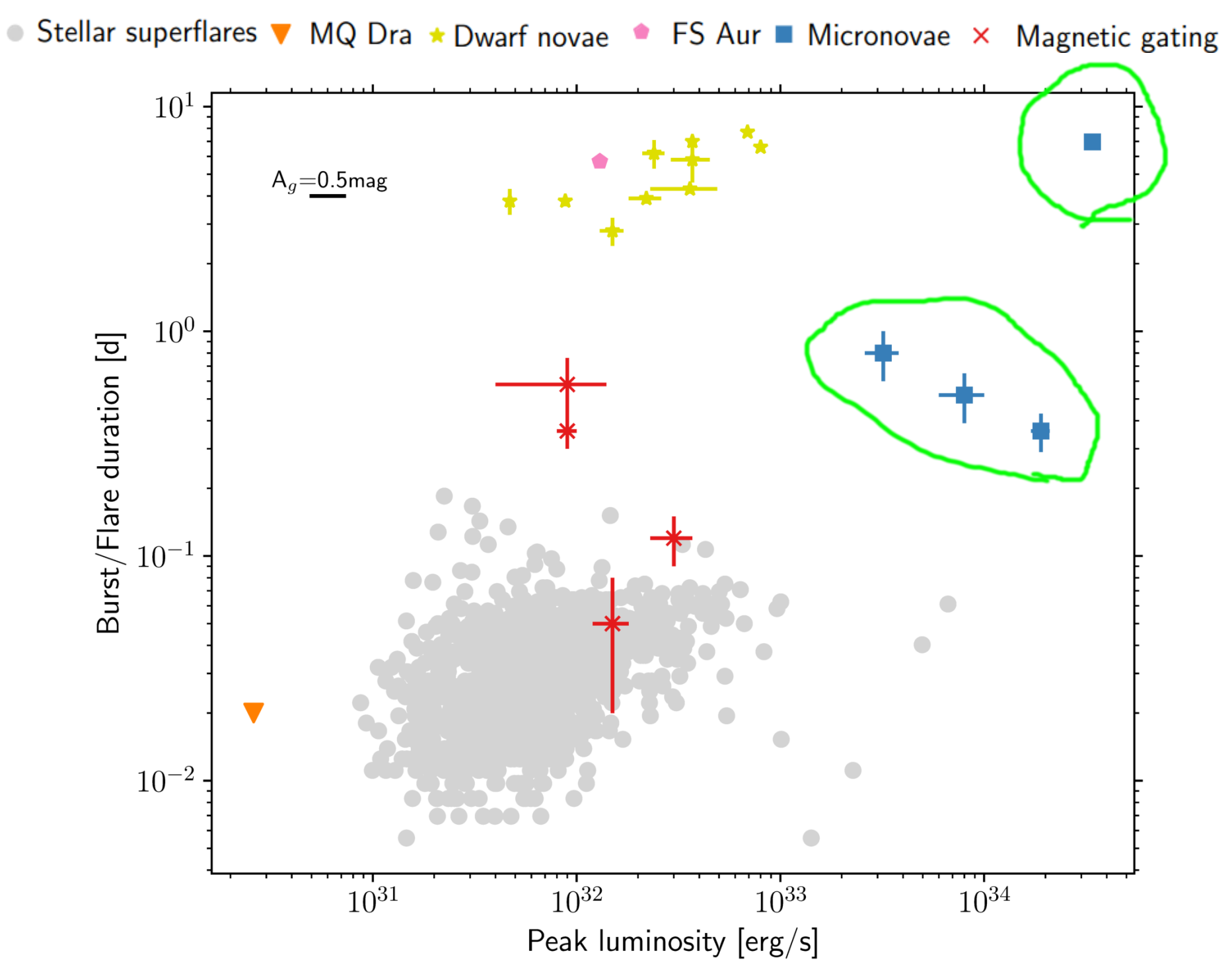

Stellar superflares
MQ Dra
Dwarf novae
FS Aur
Micronovae
A_g=0.5mag
Peak luminosity [erg/s]
10^{34}
10^{33}
10^{32}
10^{31}
10^{34}
10^{35}
10^{36}
10^{37}
10^{38}
10^{39}
Total energy [erg]


Stellar superflares
MQ Dra
Dwarf novae
FS Aur
Micronovae
Magnetic gating
A_g=0.5mag
Peak luminosity [erg/s]
10^{34}
10^{33}
10^{32}
10^{31}
10^{34}
10^{35}
10^{36}
10^{37}
10^{38}
10^{39}
Total energy [erg]

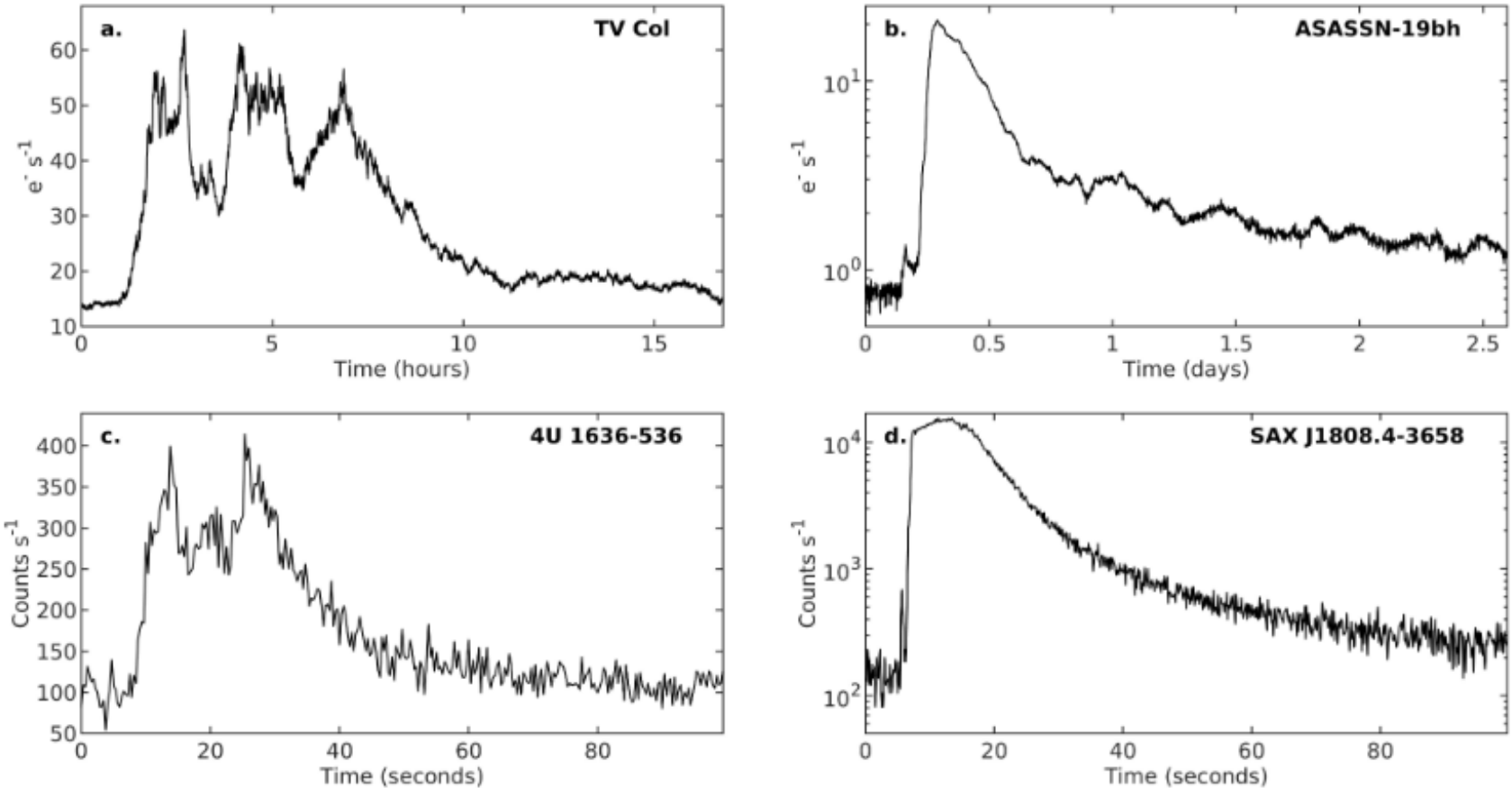

Stellar superflares
MQ Dra
Dwarf novae
FS Aur
Micronovae
Magnetic gating
Burst/Flare duration [d]
Burst/Flare frequency [1/d]
10^{1}
10^{0}
10^{-1}
10^{-2}
10^{-2}
10^{-1}
10^{0}
10^{1}


Stellar superflares
MQ Dra
Dwarf novae
FS Aur
Micronovae
Magnetic gating
Burst/Flare duration [d]
Burst/Flare frequency [1/d]
10^{1}
10^{0}
10^{-1}
10^{-2}
10^{-2}
10^{-1}
10^{0}
10^{1}

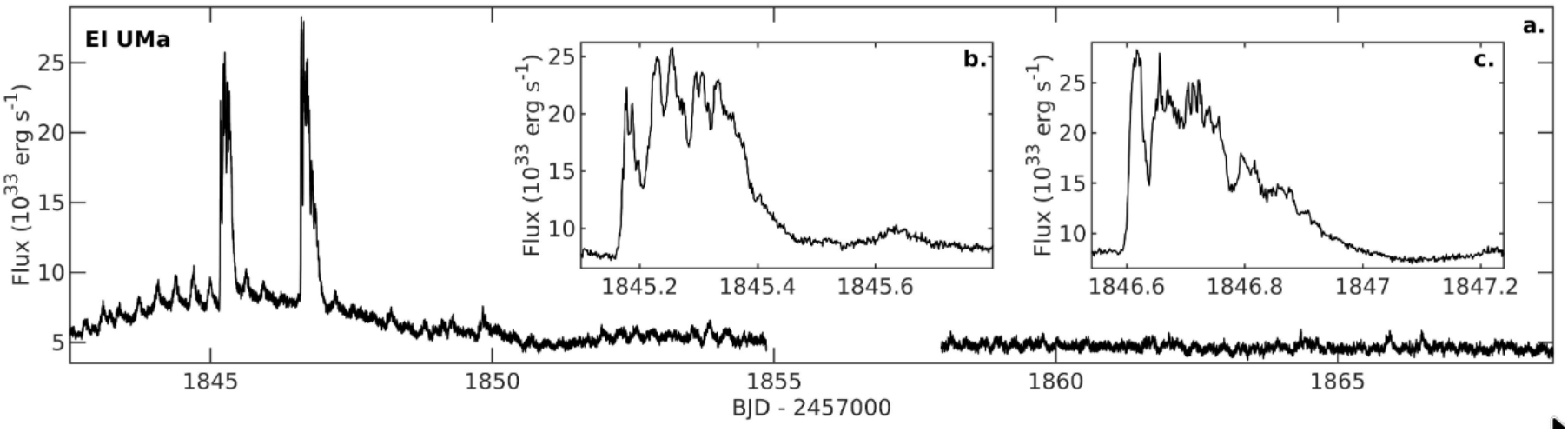

Stellar superflares
MQ Dra
Dwarf novae
FS Aur
Micronovae
Magnetic gating
A_g=0.5mag
10^1
10^0
10^{-1}
10^{-2}
Burst/Flare duration [d]
10^{31}
10^{32}
10^{33}
10^{34}
Peak luminosity [erg/s]


Stellar superflares
MQ Dra
Dwarf novae
FS Aur
Micronovae
Magnetic gating
A$_g$=0.5mag
Burst/Flare duration [d]
Peak luminosity [erg/s]
10^{1}
10^{0}
10^{-1}
10^{-2}
10^{31}
10^{32}
10^{33}
10^{34}

Comparison to Type-I X-ray bursts

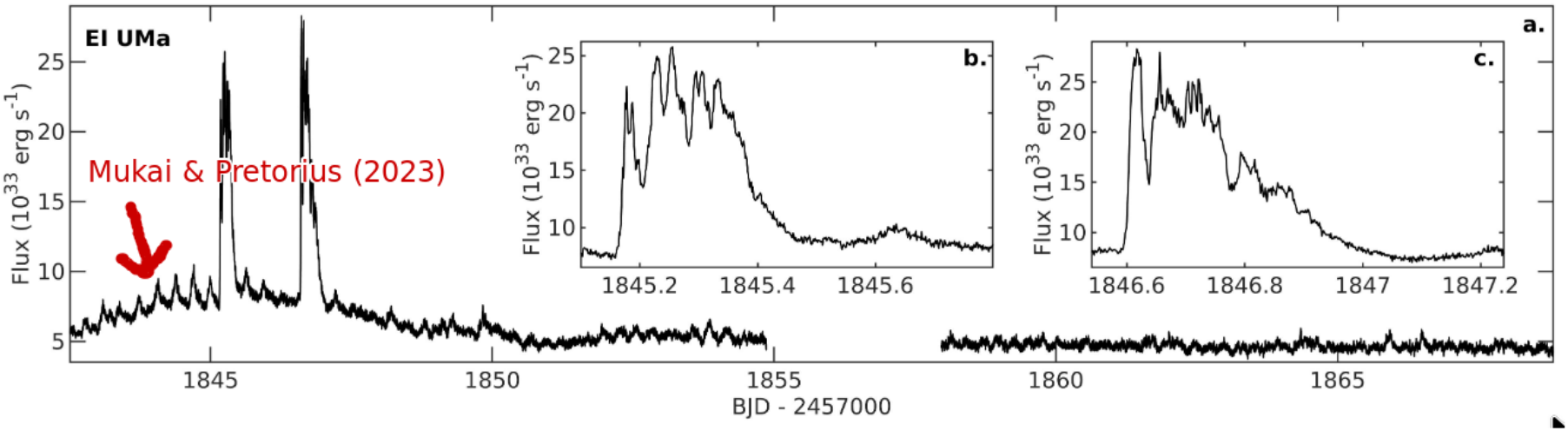


Micronovae problems



Scaringi et al. (2022)

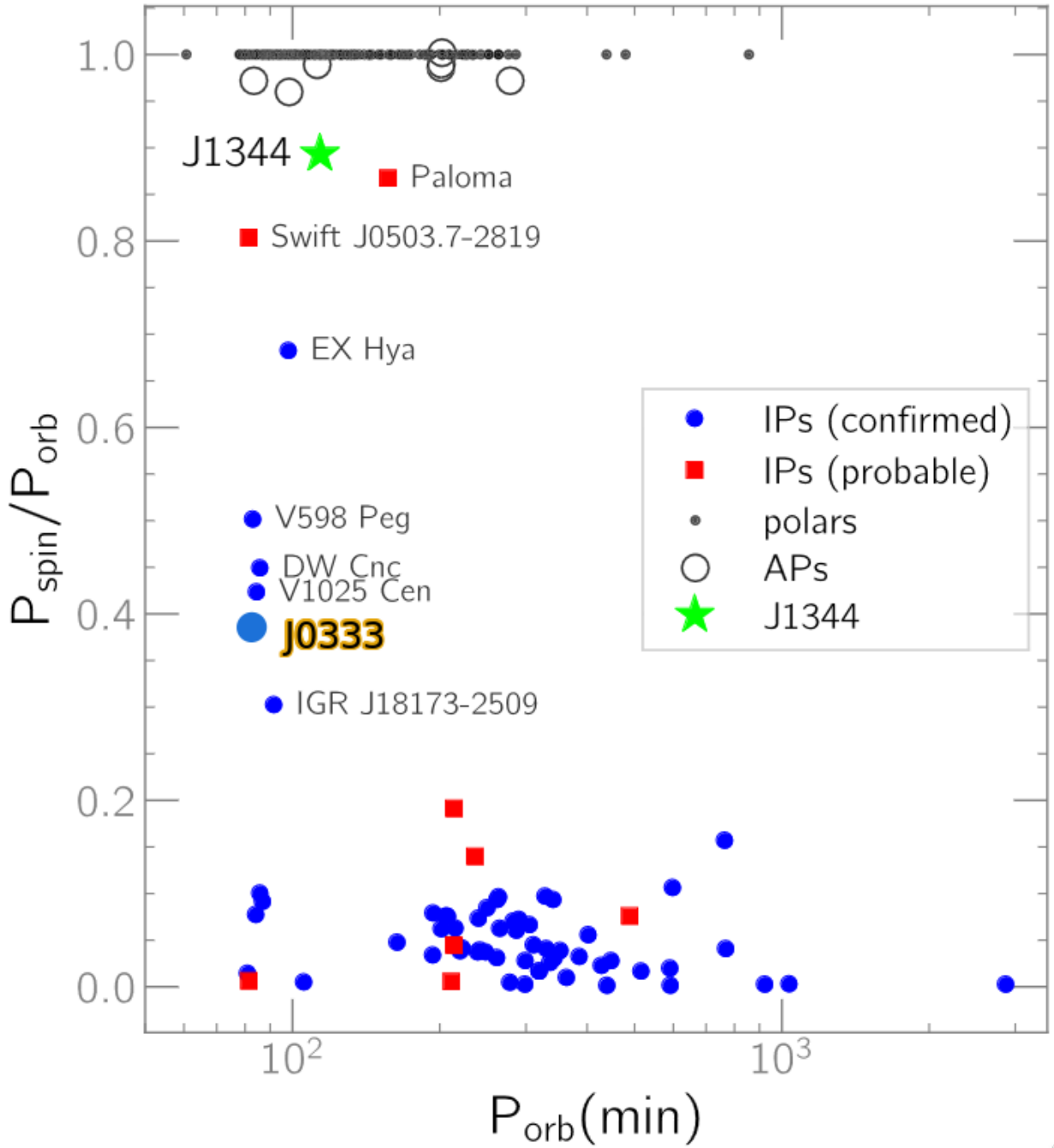
Micronovae problems



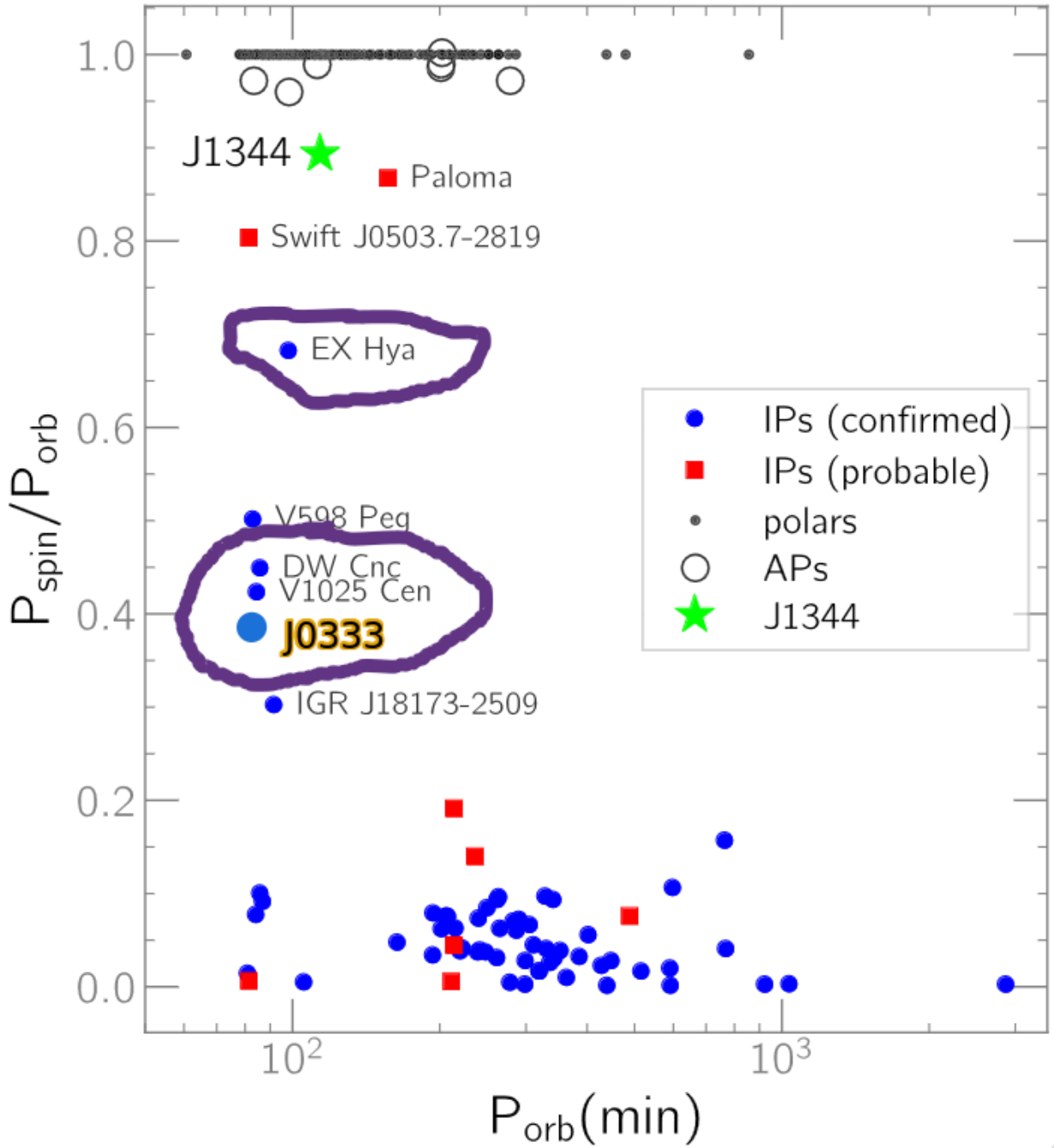
Scaringi et al. (2022)

Micronovae problems

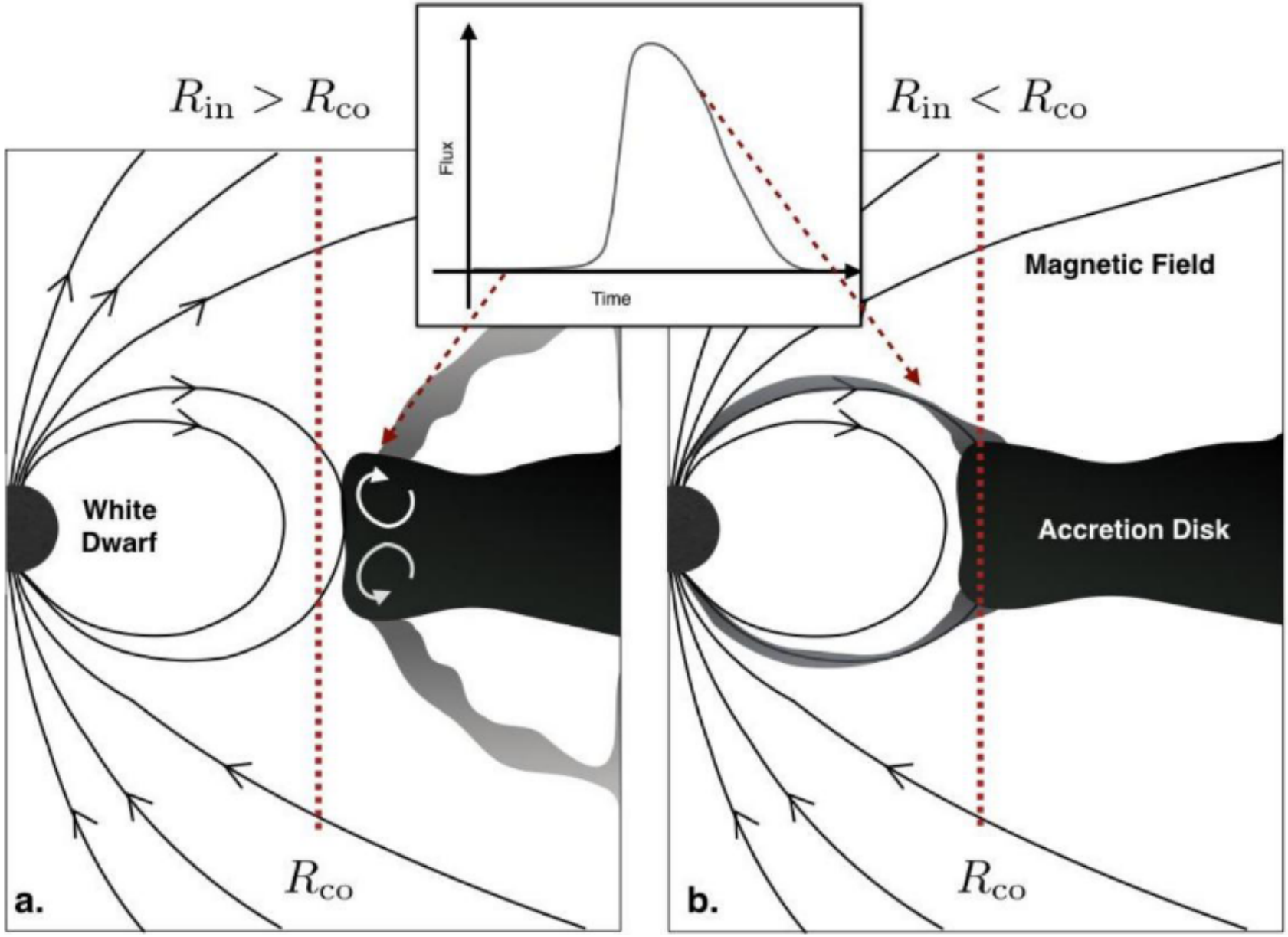
Micronovae were observed only in intermediate polars



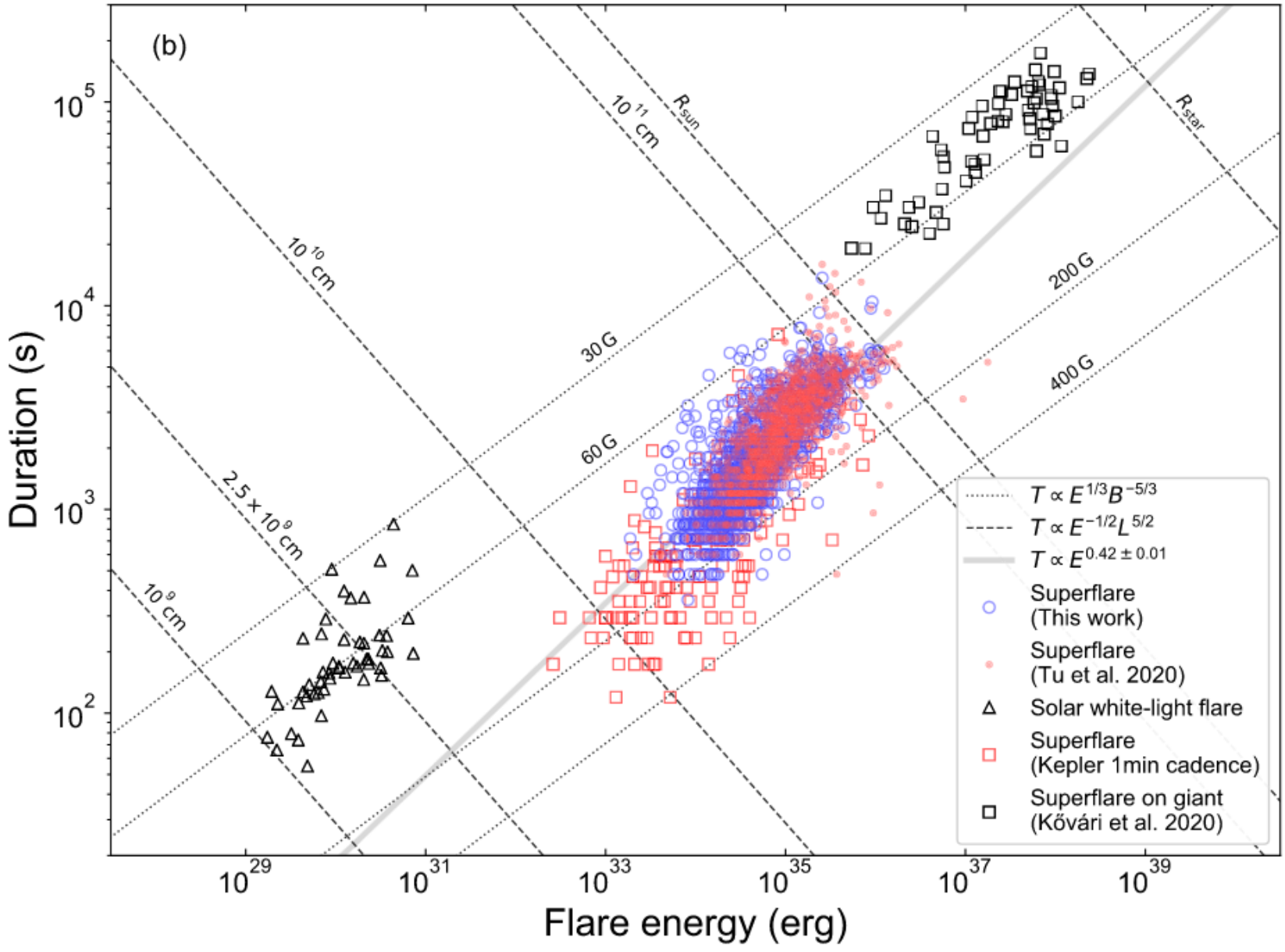
Littlefield et al. (2023)



Littlefield et al. (2023)



Scaringi et al. (2017)


(b)
Duration (s)
Flare energy (erg)
10^5
10^4
10^3
10^2
10^{29}
10^{31}
10^{33}
10^{35}
10^{37}
10^{39}
10^{11} cm
R_{sun}
R_{star}
10^{10} cm
2.5×10^{9} cm
10^{9} cm
30 G
60 G
200 G
400 G
$T \propto E^{1/3}B^{-5/3}$
$T \propto E^{-1/2}L^{5/2}$
$T \propto E^{0.42\pm0.01}$
Superflare (This work)
Superflare (Tu et al. 2020)
Solar white-light flare
Superflare (Kepler 1min cadence)
Superflare on giant (Kővári et al. 2020)

Tu et al. (2021)

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Classifying Optical (Out)bursts in Cataclysmic Variables: The Distinct Observational Characteristics of Dwarf Novae, Micronovae, Stellar Flares, and Magnetic Gating

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[5] Department of Physics and Astronomy. University of Southampton, Southampton SO17 1BJ, UK
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