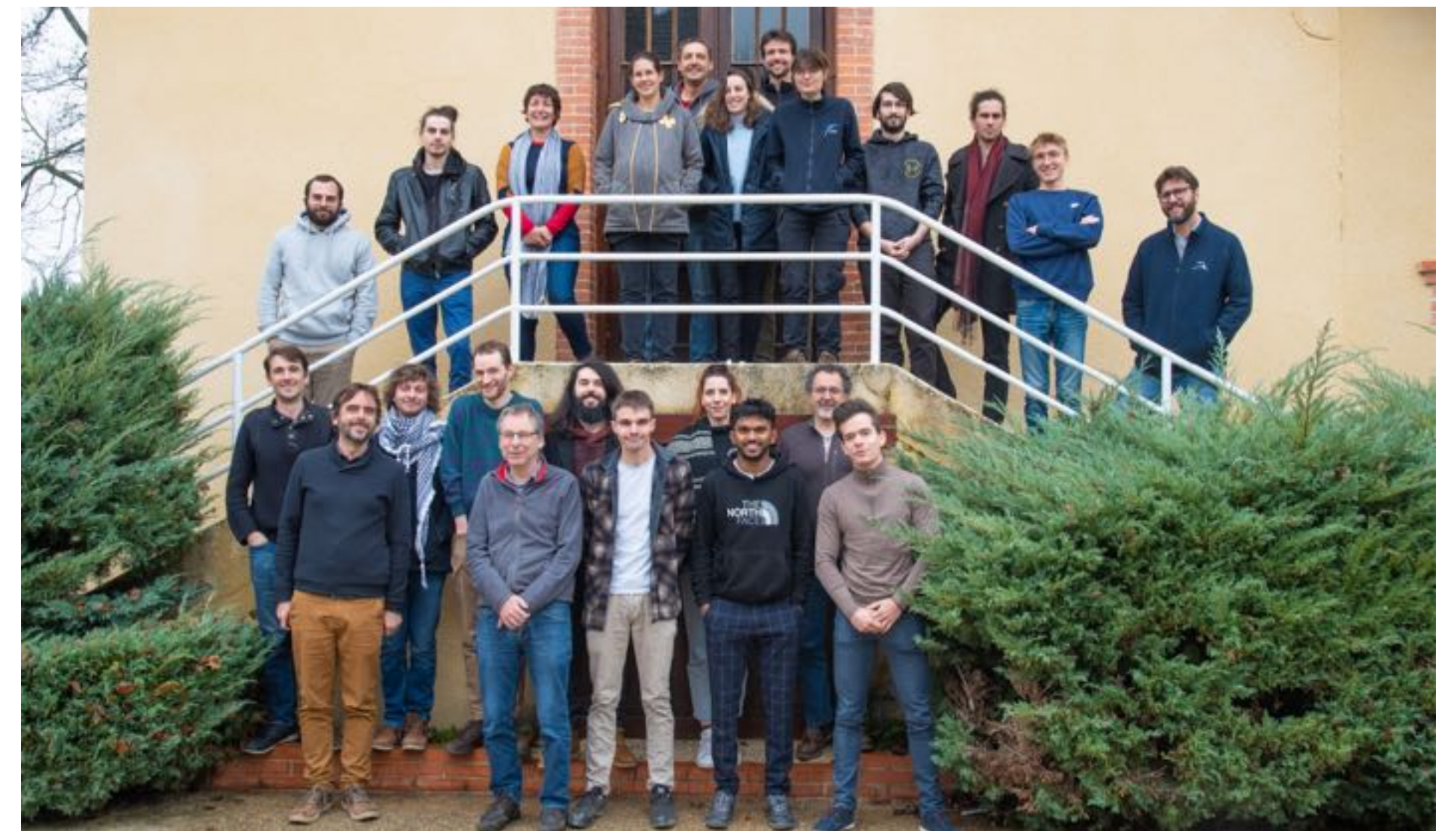# IPAG SHERPAS team, a brief presentation

Guillaume Dubus

- ▸ **High-energy emission** (XMM, Chandra, NuSTAR, IXPE, SVOM, CTA)

- ▸ Kinetic plasma processes, magnetic reconnection

- ▸ Accretion-ejection phenomena

- ▸ Dynamics of protoplanetary discs

- ▸ Astrocladistics and astrostatistics

*interest in Rubin-LSST*: transients and variable stars

currently: 8 permanent staff, 3 postdocs,11 PhD students,1 visiting professor (**Darryl Haggard**)

X-ray binaries: a lab for accretion ejection processes

relativistic jet
and/or disc wind

companion star

mass transfer :
stellar wind or
Roche lobe overflow

neutron star
or black hole

orbital period:
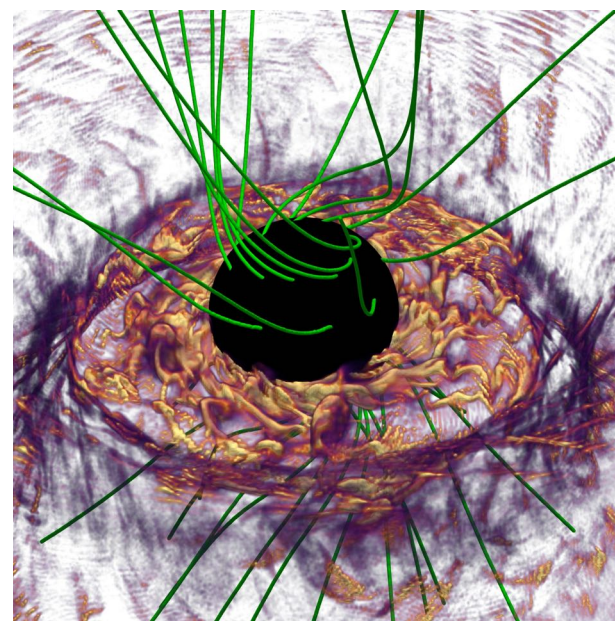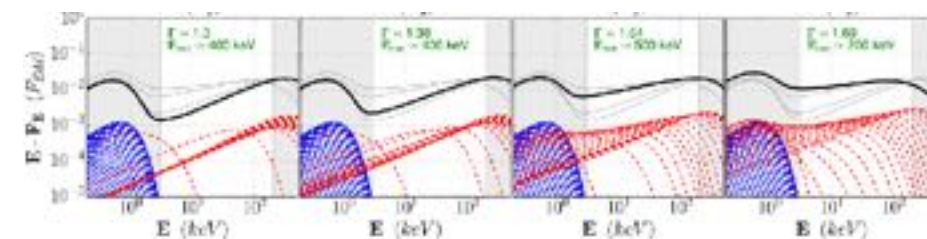hours to days

accretion disc

Key questions

- ▸ How is matter transported in the accretion disc ?

- ▸ What drives disc winds and relativistic jets ?

- ▸ How is gravitational energy released ?

- ▸ Is rotational energy extracted from the black hole or neutron star ?

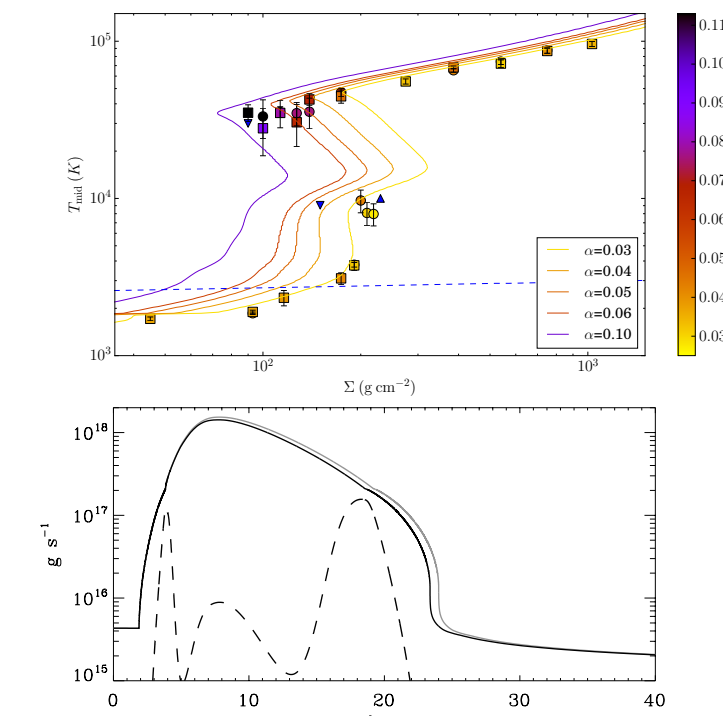- ▸ Where are stellar-mass black holes hiding ?
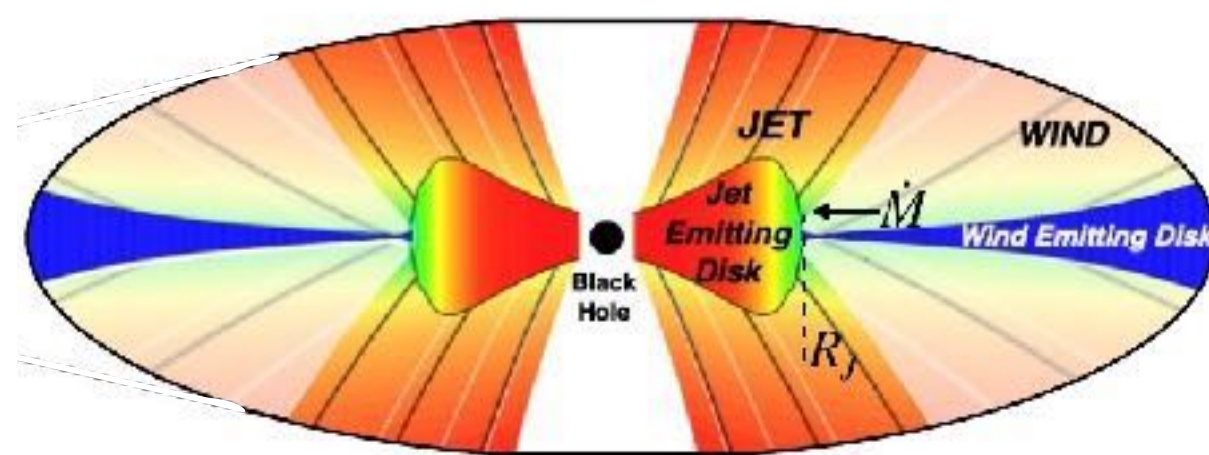
Jet emitting disk model
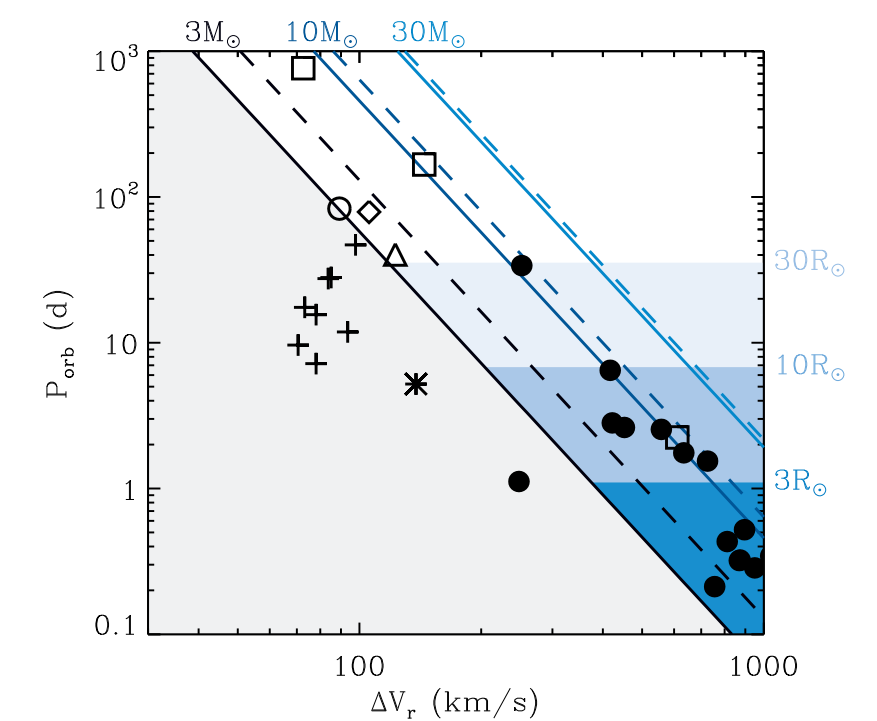(Ferreira, Petrucci+ 2006,
Marcel+ 2018)

Black hole magnetosphere
(Crinquand+ 2022)
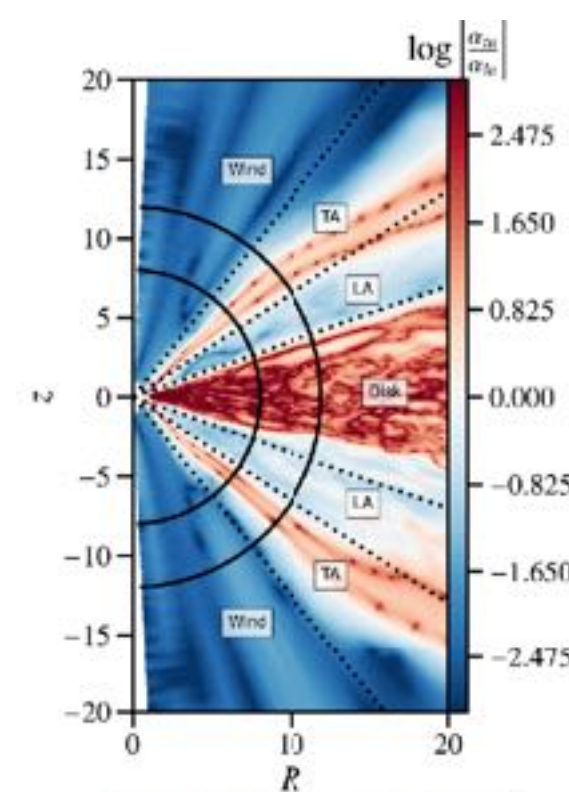
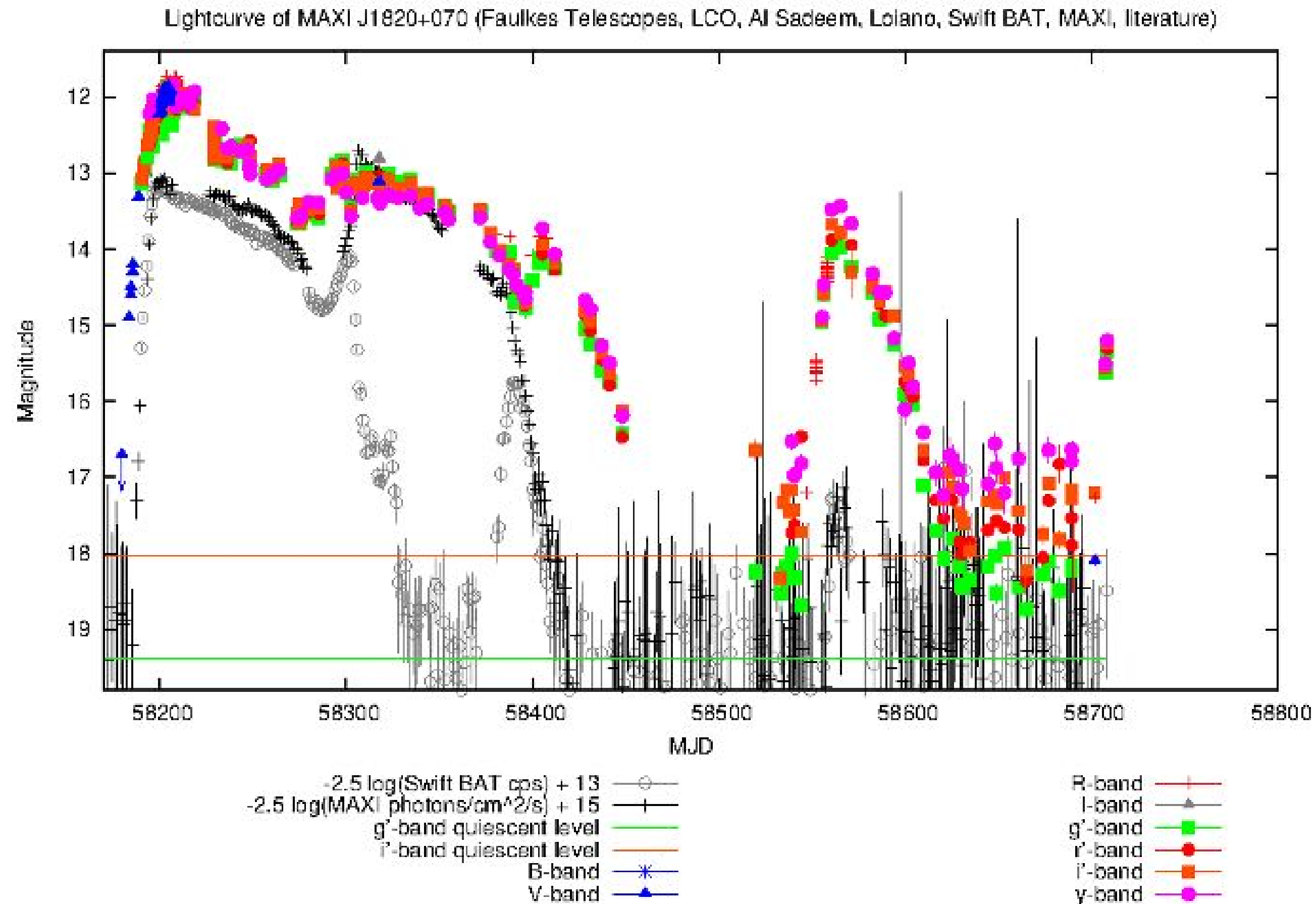Magnetic outflows
(Jacquemin-Ide+ 2021)

Thermal stability of discs
(Scepi+ 2018, Dubus+ 2018)

Black hole candidates from RV surveys
(Clavel+ 2021)

X-ray binaries are **optical** variable stars

Lightcurve of MAXI J1820+070 (Faulkes Telescopes, LCO, Al Sadeem, Lolano, Swift BAT, MAXI, literature)

‣ Recurrent **outbursts** (months) followed by quiescence (years) due to disc instability modulating accretion/ejection.

‣ Typically, X-ray discovery triggers multiwavelength observations.

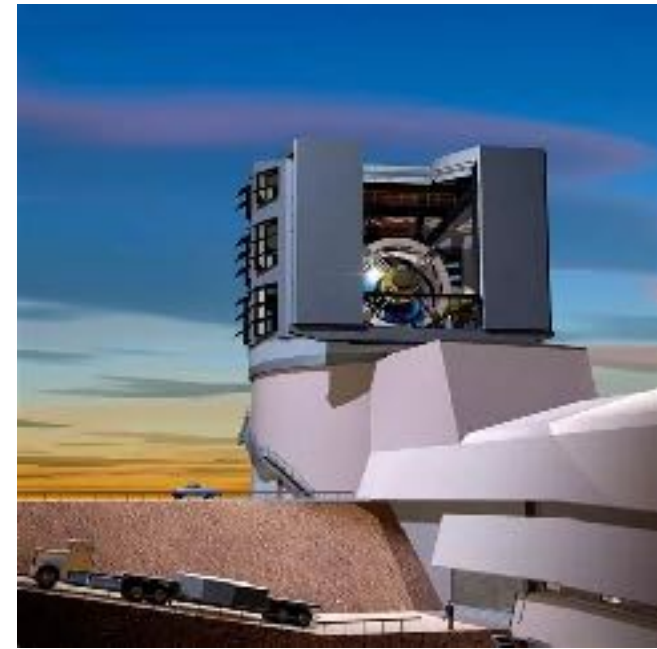‣ Optical traces outer disc, sometimes jet.

Optical precursors to outbursts ?

X-ray optical delay, colour evolution ?

Orphan optical outbursts ('misfires') ?
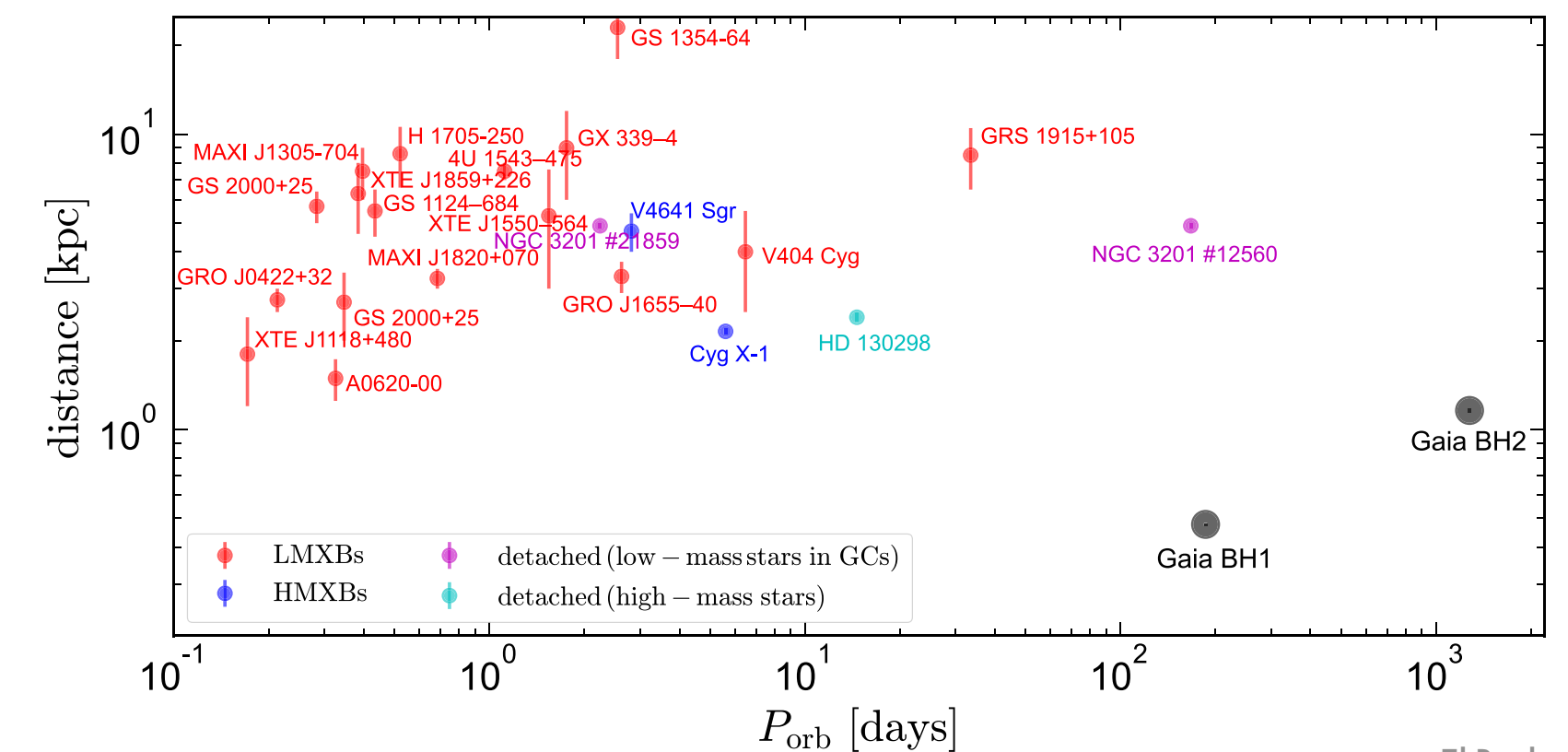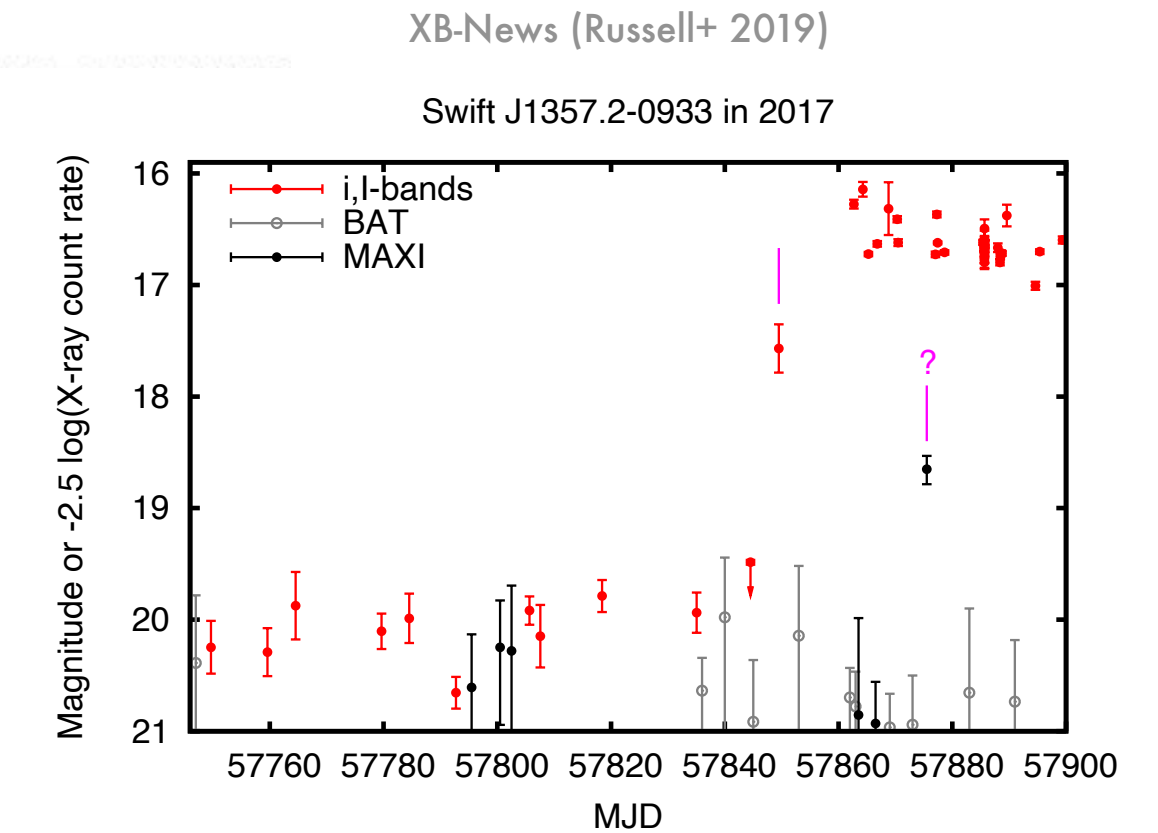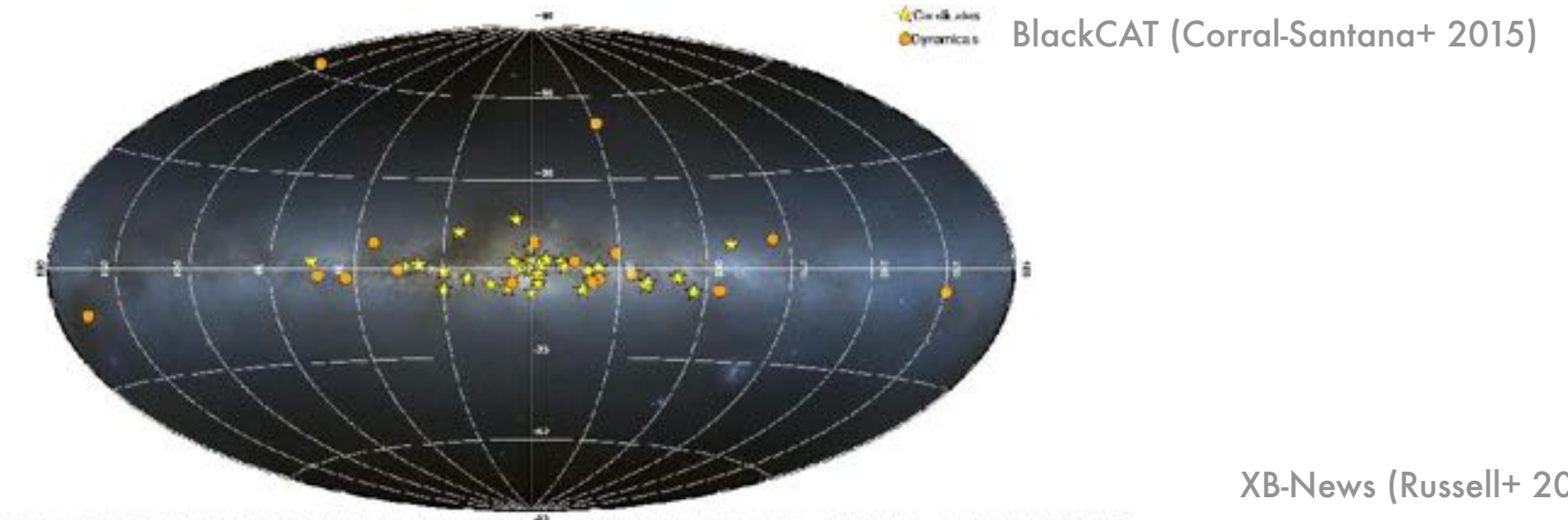
Variability in quiescence ?

A Rubin-LSST program

Monitor activity in known sources & provide optical triggers.

BlackCAT (Corral-Santana+ 2015)

Uncover X-ray faint binaries through their optical outbursts.

XB-News (Russell+ 2019)

Swift J1357.2-0933 in 2017

Help identify new X-ray transients & candidate dormant black holes (*Gaia*).

Limitations due to cadence, Gal. Plane coverage ?
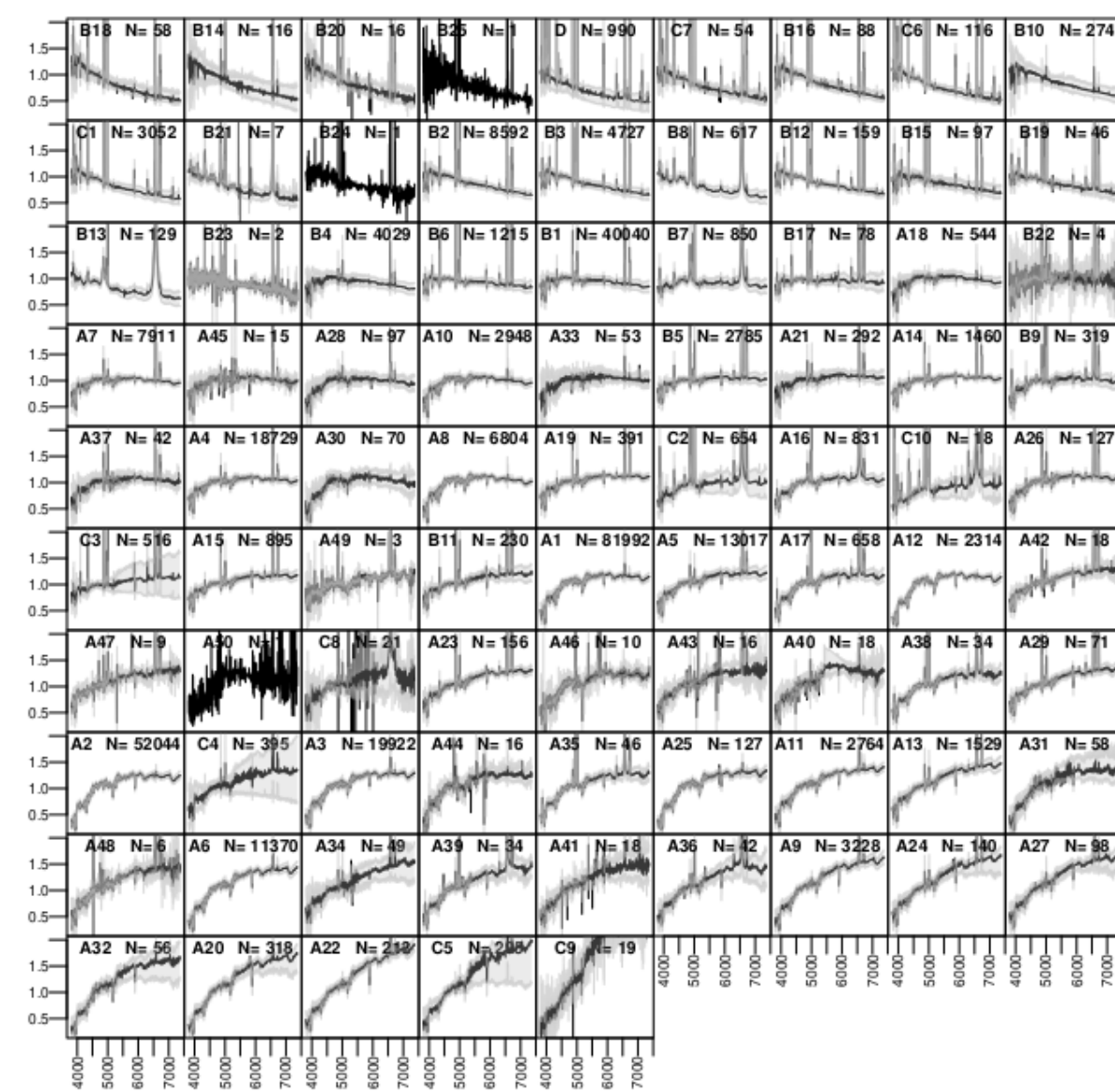
Implementation in a variability broker ?

El-Badry+ 2023

Astrostatistics: unsupervised classification

Unsupervised classification of galaxies with the FisherEM algorithm (discriminant latent-subspace mixture model)

D. Fraix-Burnet, J. Dubois, J. Moultaka, H. Chambon, C. Beissière-Thygesen, C. Bouveyron, A. Sinha.
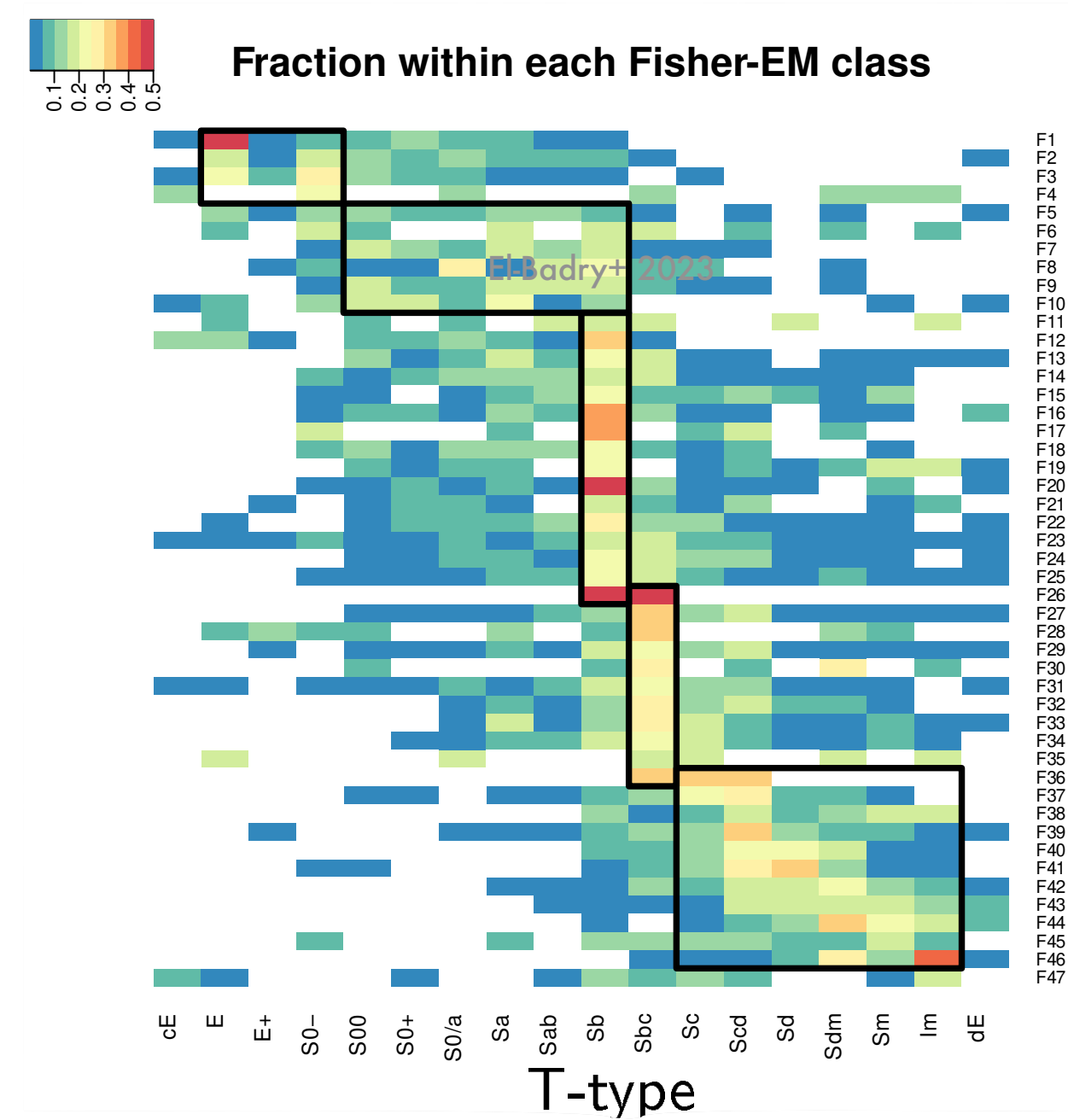
702000 SDSS spectra

Fraix-Burnet+ 2021

EFIGI sample of galaxy images

Fraix-Burnet+ 2023

86 classes