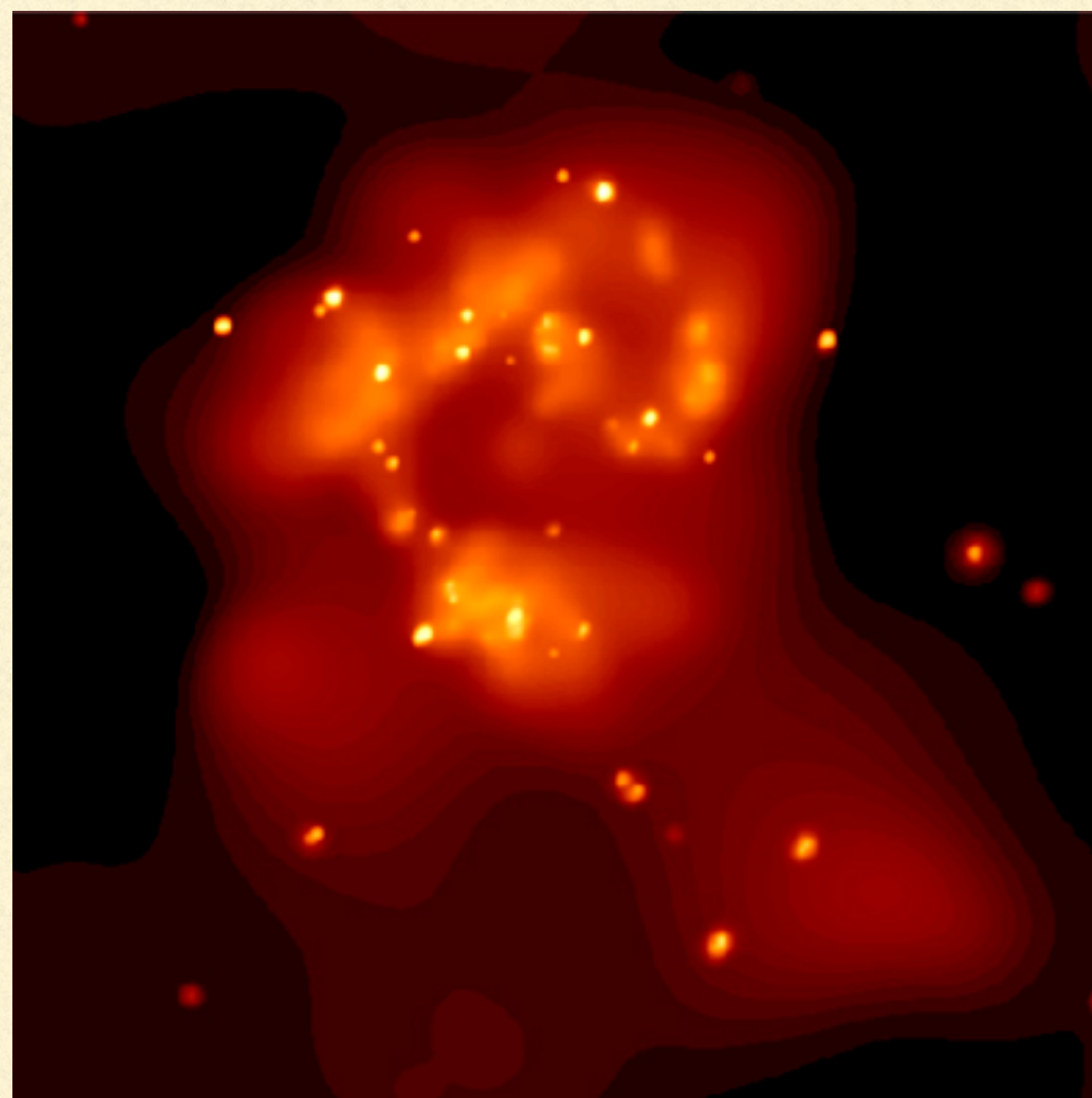

CAMK ANNUAL MEETING 2024



















Jean-Pierre Lasota



31th of January 2024



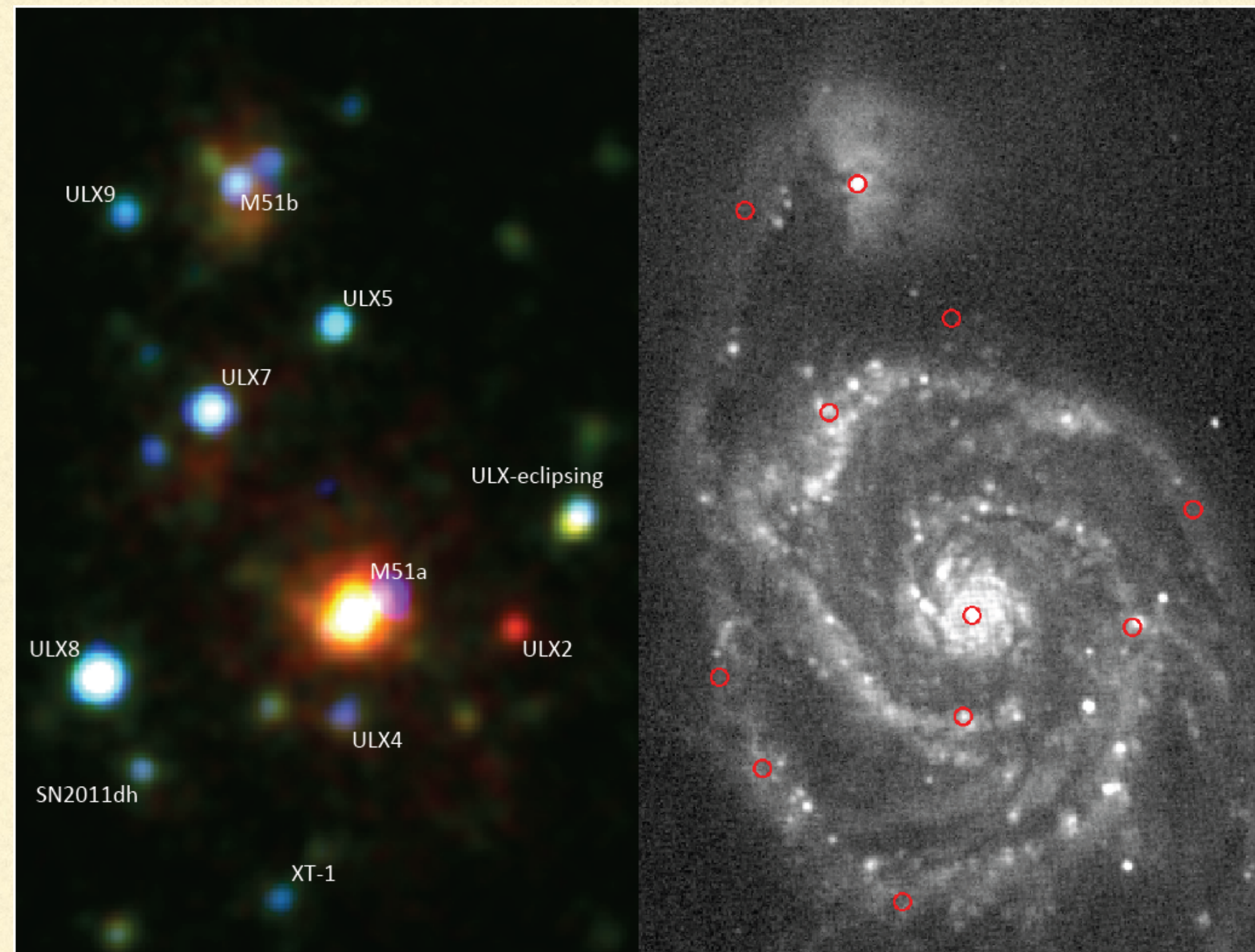
Publications 2023

- 1 2023MNRAS.526.2506L 2023/12 cited: 2   
Ultraluminous X-ray sources are beamed
Lasota, Jean-Pierre; King, Andrew
- 2 2023arXiv231116013L 2023/11   
Problems in the astrophysics of accretion onto compact celestial bodies
Lasota, Jean-Pierre
- 3 2023ATel16272....1H 2023/10   
First X-ray detection of the new outburst of Swift J1753.5-0127 and continuing optical brightening
Homan, J.; Alabarta, K.; Russell, D. M. *and 16 more*
- 4 2023ApJ...951...51B 2023/07 cited: 4   
A New Sample of Transient Ultraluminous X-Ray Sources Serendipitously Discovered by Swift/XRT
Brightman, Murray; Hameury, Jean-Marie; Lasota, Jean-Pierre *and 11 more*
- 5 2023NewAR..9601672K 2023/06 cited: 25   
Ultraluminous X-ray sources
King, Andrew; Lasota, Jean-Pierre; Middleton, Matthew
- 6 2023arXiv230207925L 2023/02   
AGN Accretion Discs
Lasota, Jean-Pierre

Ultraluminous X-ray sources (ULXs):

$$L > 10^{39} \text{erg s}^{-1} \gtrsim L_{\text{Edd}} (10 M_{\odot})$$

off galactic center



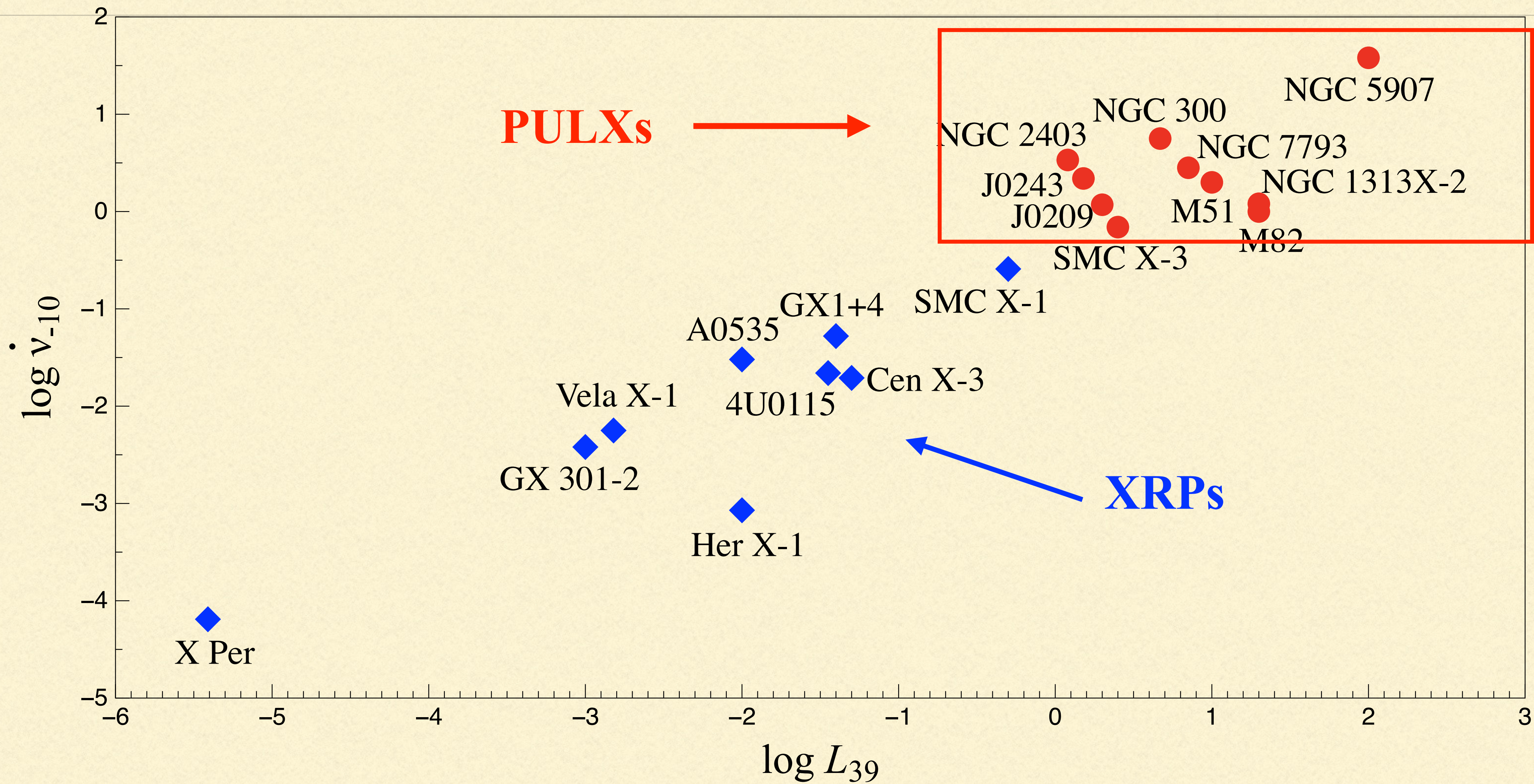
Pulsing ULXs (PULXs), magnetized neutron stars: L up to 10^{41} erg/s $\sim 1000 L_{\text{Edd}}$

Two possibilities:

- a. Beaming (luminosity is only apparently super Eddington): $L_{\text{app}} \approx \frac{1}{b} L_{\text{Edd}} \ln \frac{\dot{M}}{\dot{M}_{\text{Edd}}}$
 $b < 1$
- b. Very strong magnetic field (magnetar), L_{Edd} is no longer the critical luminosity:

$$L_{\text{crit}} \approx 900 B_{14}^{4/3} L_{\text{Edd}} \qquad L_{\text{Edd}} < L = L_{\text{app}} < L_{\text{crit}}$$

I have demonstrated that b. is impossible



All PULXs have

$$L_X > 10^{39} \text{ erg/s} \quad \text{and}$$

$$\dot{v} \gtrsim 10^{-10} \text{ s}^{-2}$$

Spin-up by torque from a keplerian accretion disc

$$\dot{\nu} = \frac{\dot{J}(R_M)}{2\pi I} = \frac{\dot{M}(GMR_M)^{1/2}}{2\pi I} \propto \dot{M}^{6/7} \mu^{2/7}, \quad R_M \propto \dot{M}^{-2/7} \mu^{4/7}$$

gives the accretion rate

$$\dot{M} \approx 1.2 \times 10^{18} \dot{\nu}_{-10}^{7/6} \mu_{32}^{-1/3} \text{ g/s} \quad \mu_{32} \text{ corresponds to } 10^{14} \text{ G}$$

accretion subcritical

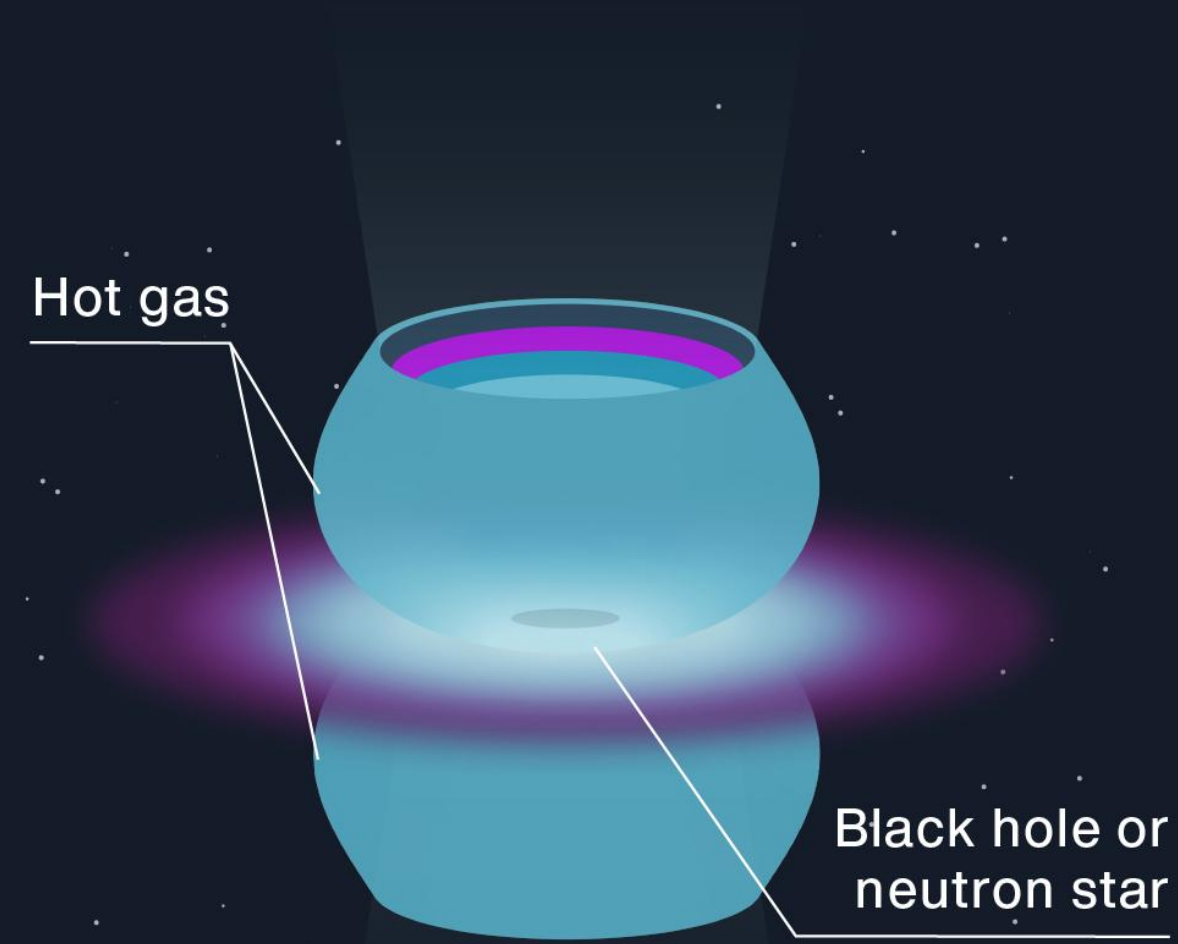
$$L_X \approx 0.1 \dot{M} c^2$$

$$L_X \approx 9 \times 10^{37} \dot{\nu}_{-10}^{7/6} \mu_{32}^{-1/3} \text{ erg/s} < L_{\text{Edd}} \ll 10^{40} \text{ erg/s}$$

The presence of magnetars in PULXs is ruled out, because the large magnetospheric radius coupled with the high accretion rate would spin up the magnetar too quickly.

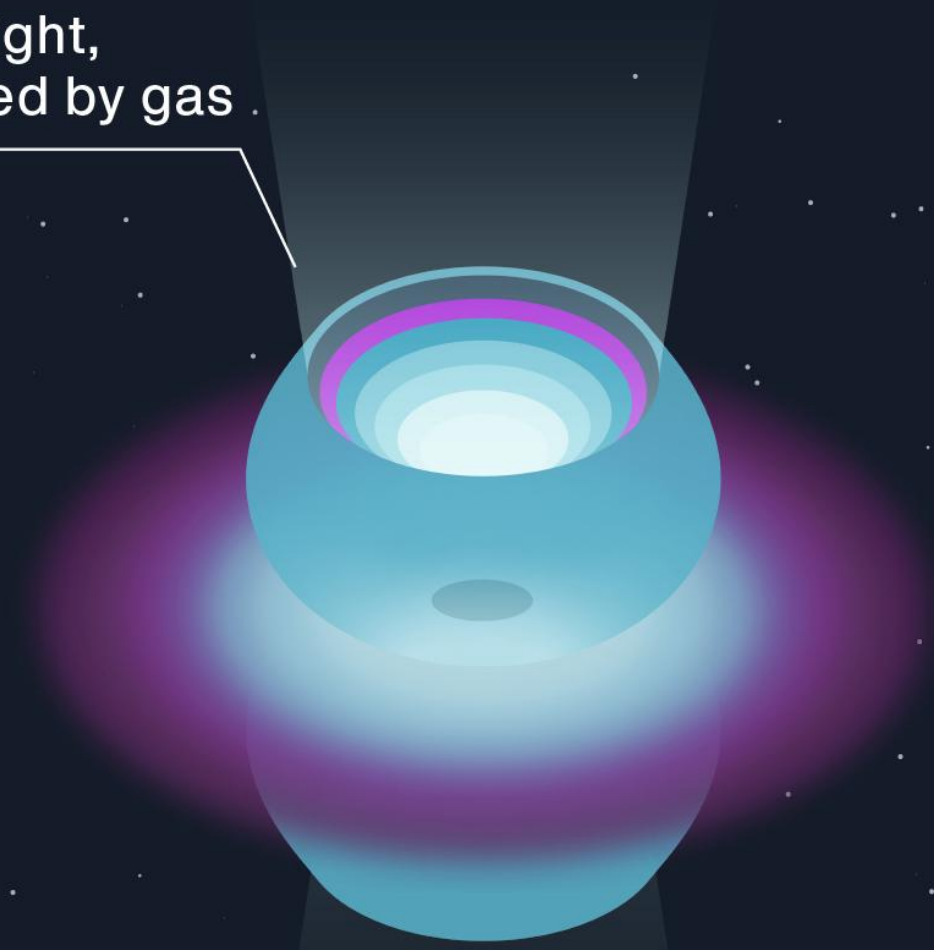
All PULXs and (at least) some ULXs are beamed

POINTED AWAY FROM EARTH



SS 433, Cyg X-3

X-ray light,
confined by gas



TILTED TOWARD EARTH

Source of X-ray light



PULX

NASA/JPL-Caltech - <https://photojournal.jpl.nasa.gov/jpeg/PIA24574.jpg>

Outreach: the year of the anthropic principle

TEMAT Z OKŁADKI

Wszechświat nie wie o naszym istnieniu

WZLOT I UPADEK ZASADY ANTROPICZNEJ

Jean-Pierre Lasota

Wiele wydaje się wskazywać, że żyjemy we Wszechświecie, w którym wartości stałych fizycznych są precyzyjnie ze sobą dostrojone. Nawet najdrobniejsza zmiana którejkolwiek z nich spowodowałaby, że nas by nie było! Ale czy na pewno Wszechświat musi być tak przychylny naszemu istnieniu? A może jest wiele wszechświatów i tylko w jednym z nich doszło do takiego dostrojenia? Czy sam fakt zaistnienia fizyko-chemicznych warunków do powstania życia wystarczy, by ono powstało? Problem w tym, że nawet jego najprostsze formy są niezwykle skomplikowane.

28 URANIA 5/2023



Astronarium 171

