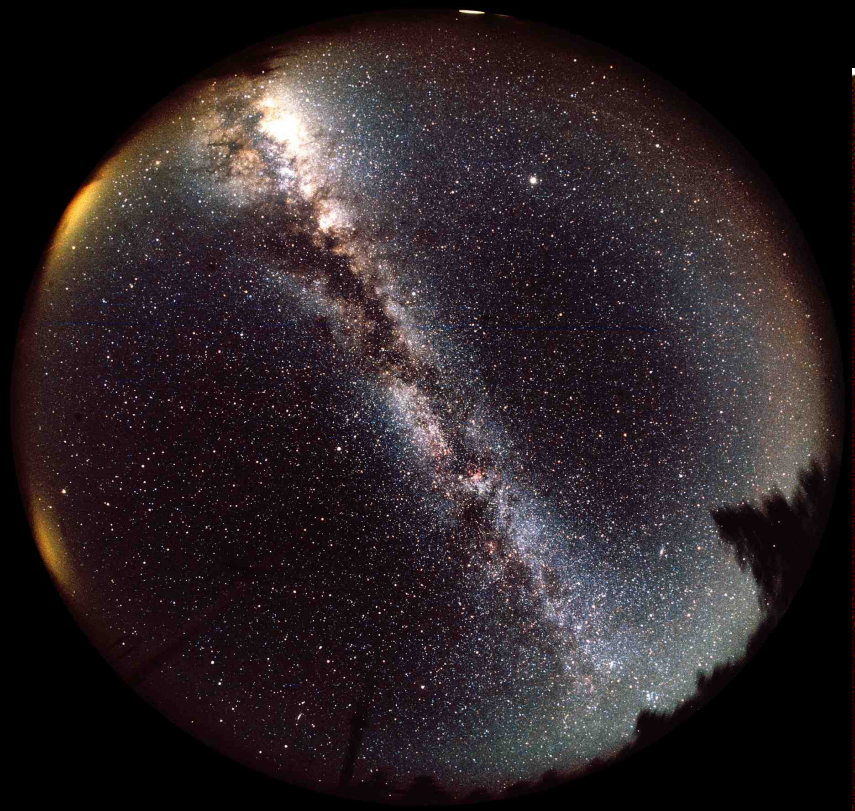
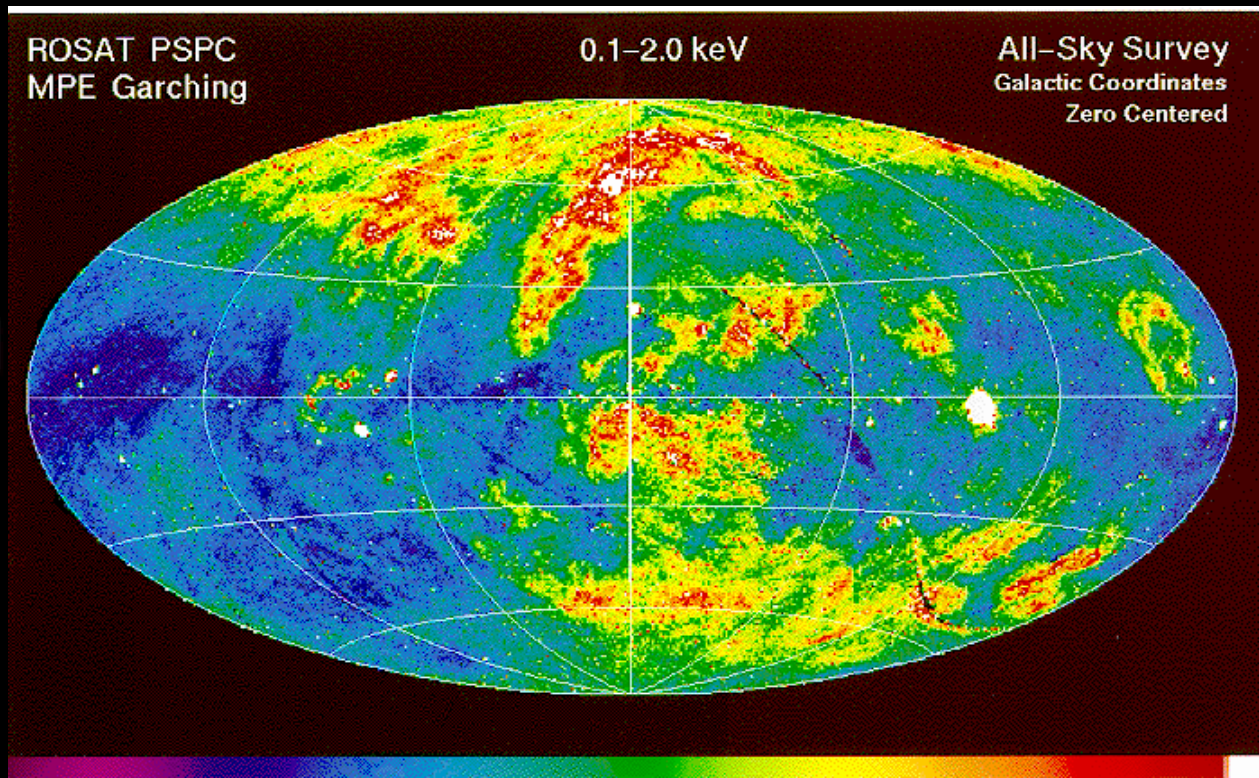
The Beasts of the X-Ray Universe

IWSSP 2008 – Brno Czech Republic

X-ray sky vs. “optical” sky

Using your eyes, you can see almost 5000 *(may be even more)* stars on night sky.
Using your fictive X-ray eyes, you can see only few dozens.
But there are only beasts on X-ray sky...

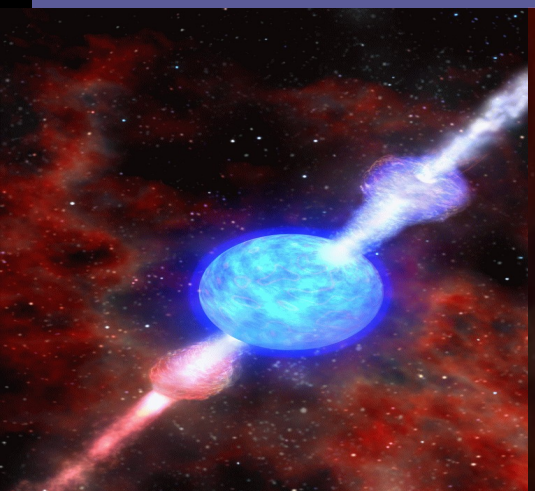
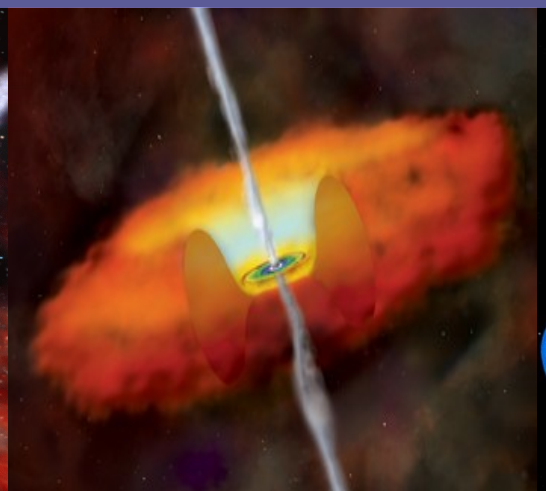
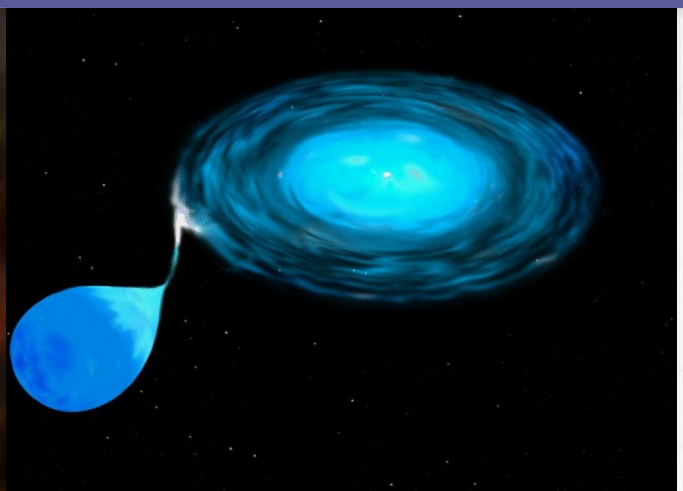




X-ray beasts classification

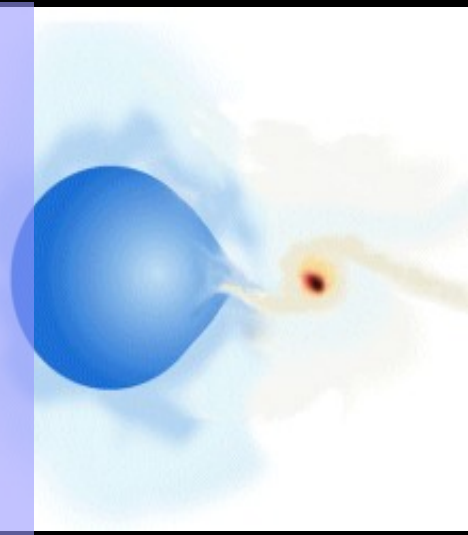
- Permanent
  - Galactic
  - Extra Galactic
- Flares
  - Galactic
  - Extra Galactic

Names of Beasts: HMXB, LMXB, Be-Stars, Black-holes, Pulsars, AGNs, Supernovas, Novas, GRB, GMF, ... and more

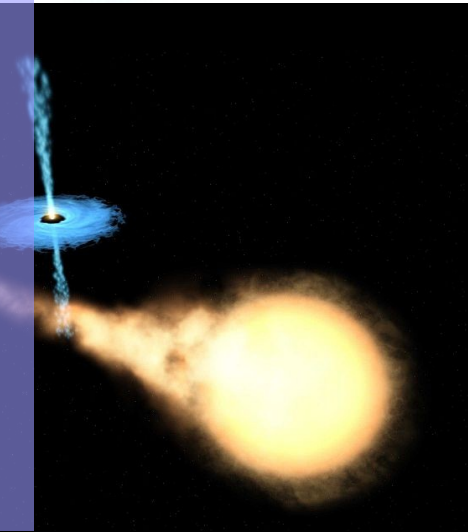




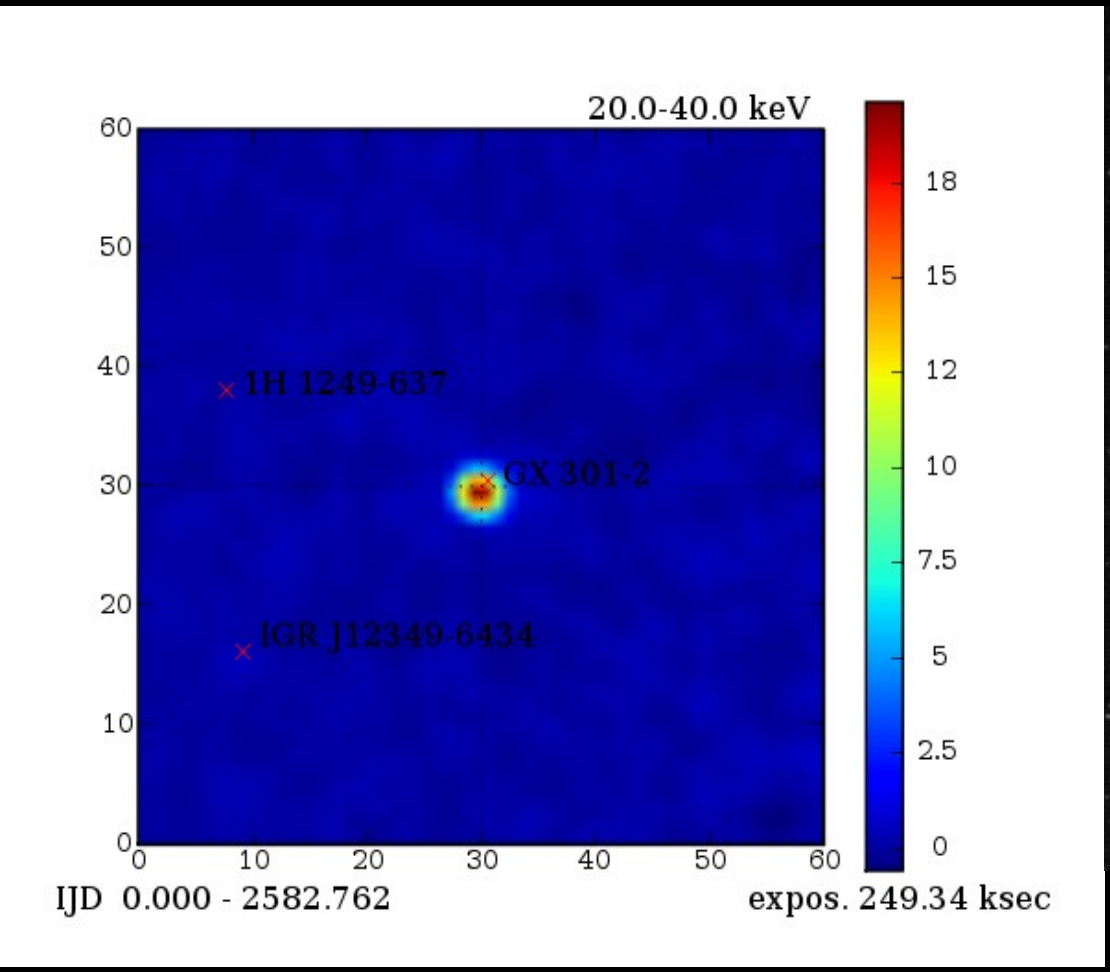

X-ray beasts from our Galaxy *(mainly)*

High-mass X-ray binary (HMXB) is a binary star system where one of the components is a neutron star or a black hole. The other component is a massive star (M > 2MSun), usually a Be star or a blue supergiant. This giant star is very bright in optical band, so we can easily find them. Most famous HMXB is Cygnus-X1



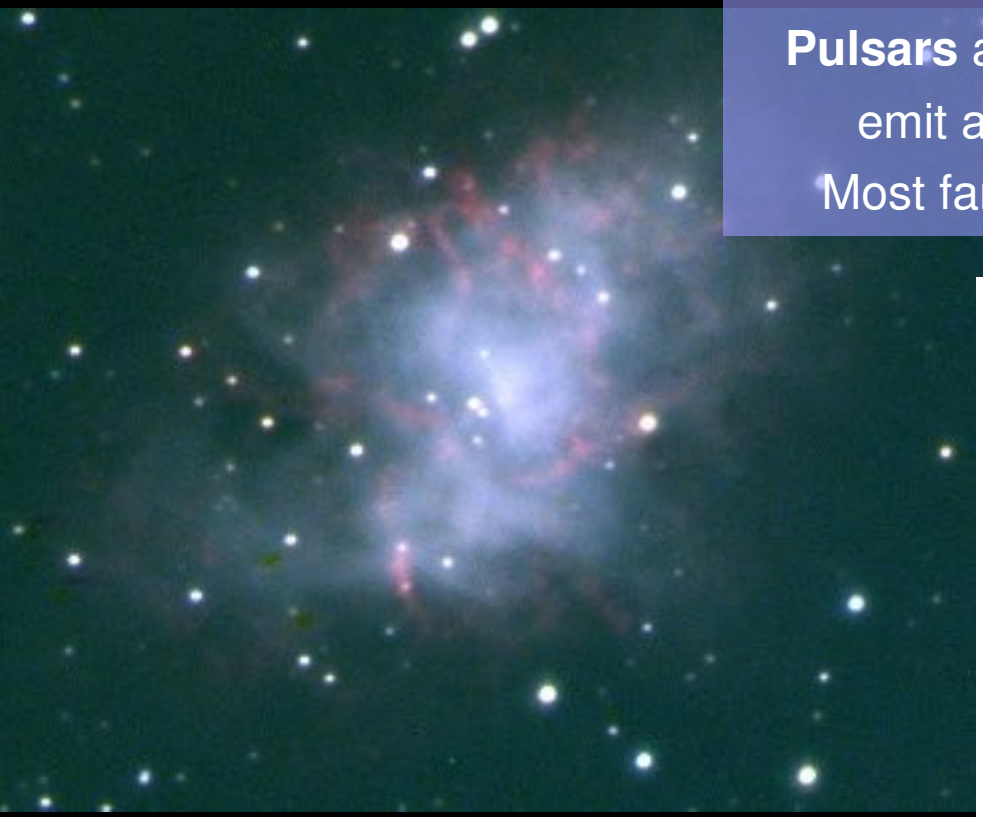
Low-mass X-ray binary (LMXB) is a binary star where one of the components is either a black hole or neutron star. The other, donor, component usually fills its Roche lobe and therefore transfers mass to the compact star. The donor is less massive than the compact object, and can be on the main sequence, a degenerate dwarf (white dwarf), or an evolved star (red giant). Many of them been found in globular clusters



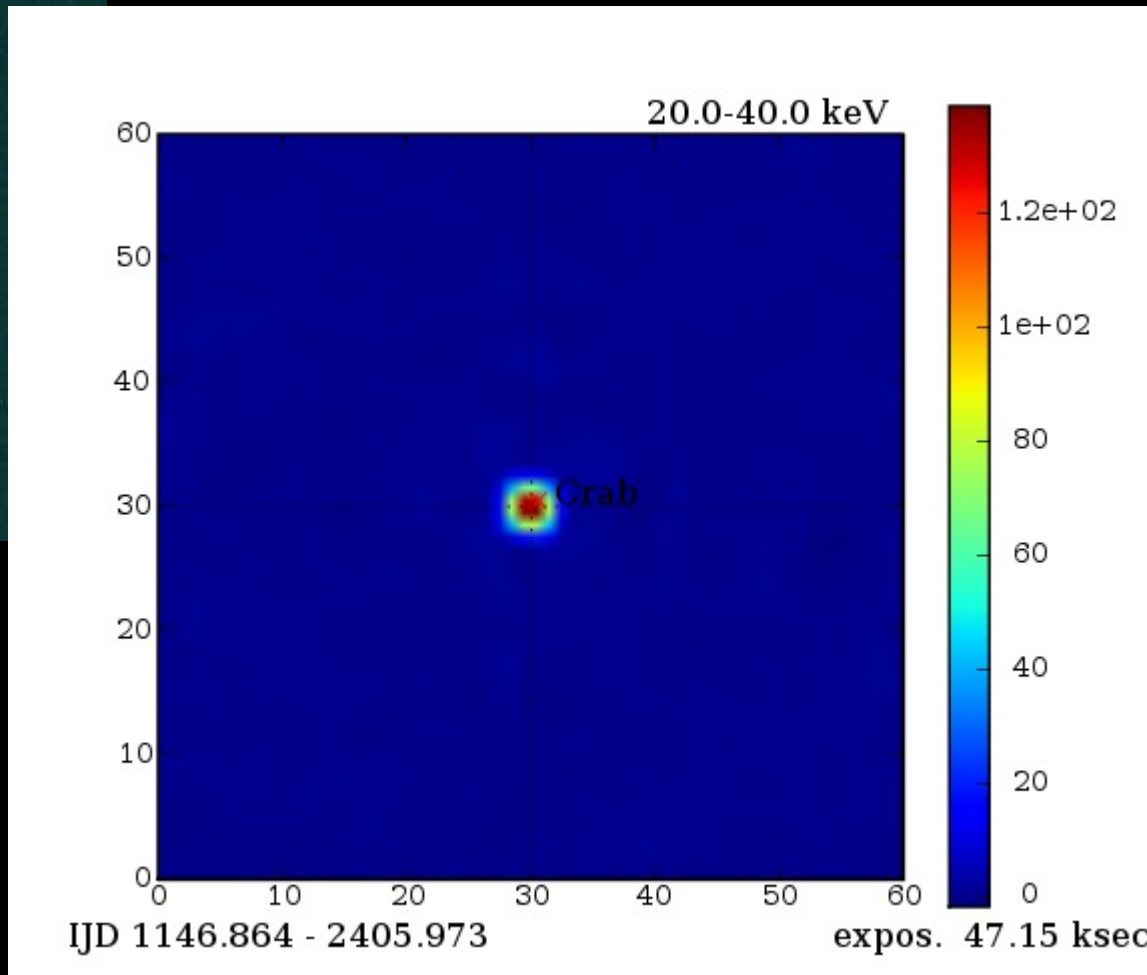


V* BP Cru -- High Mass X-ray Binary

X-ray beasts from our Galaxy *(mainly)*

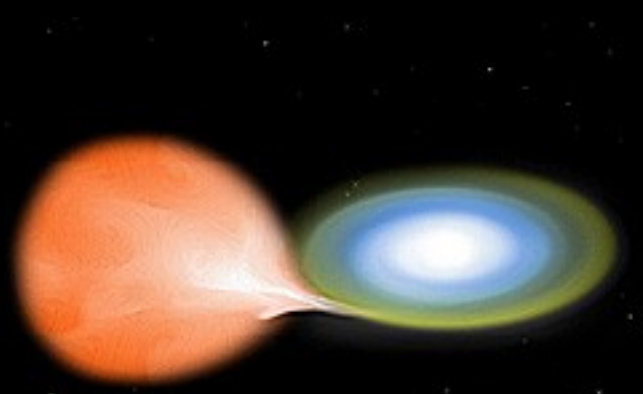


Pulsars are highly magnetized rotating neutron stars which emit a beam of detectable electromagnetic radiation.
Most famous is Crab – supernova remanent nebula - M1

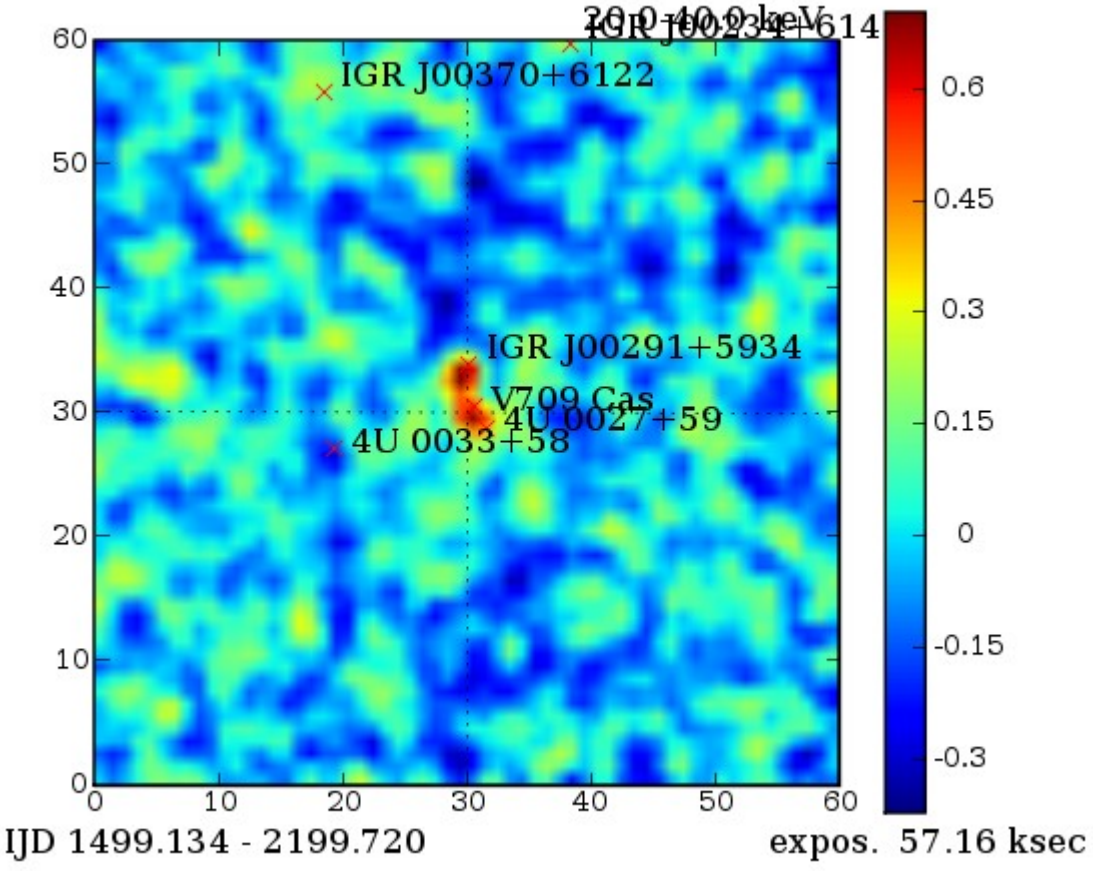


X-ray beasts from our Galaxy *(mainly)*

A nova is a cataclysmic nuclear explosion caused by the accretion of hydrogen onto the surface of a white dwarf star.

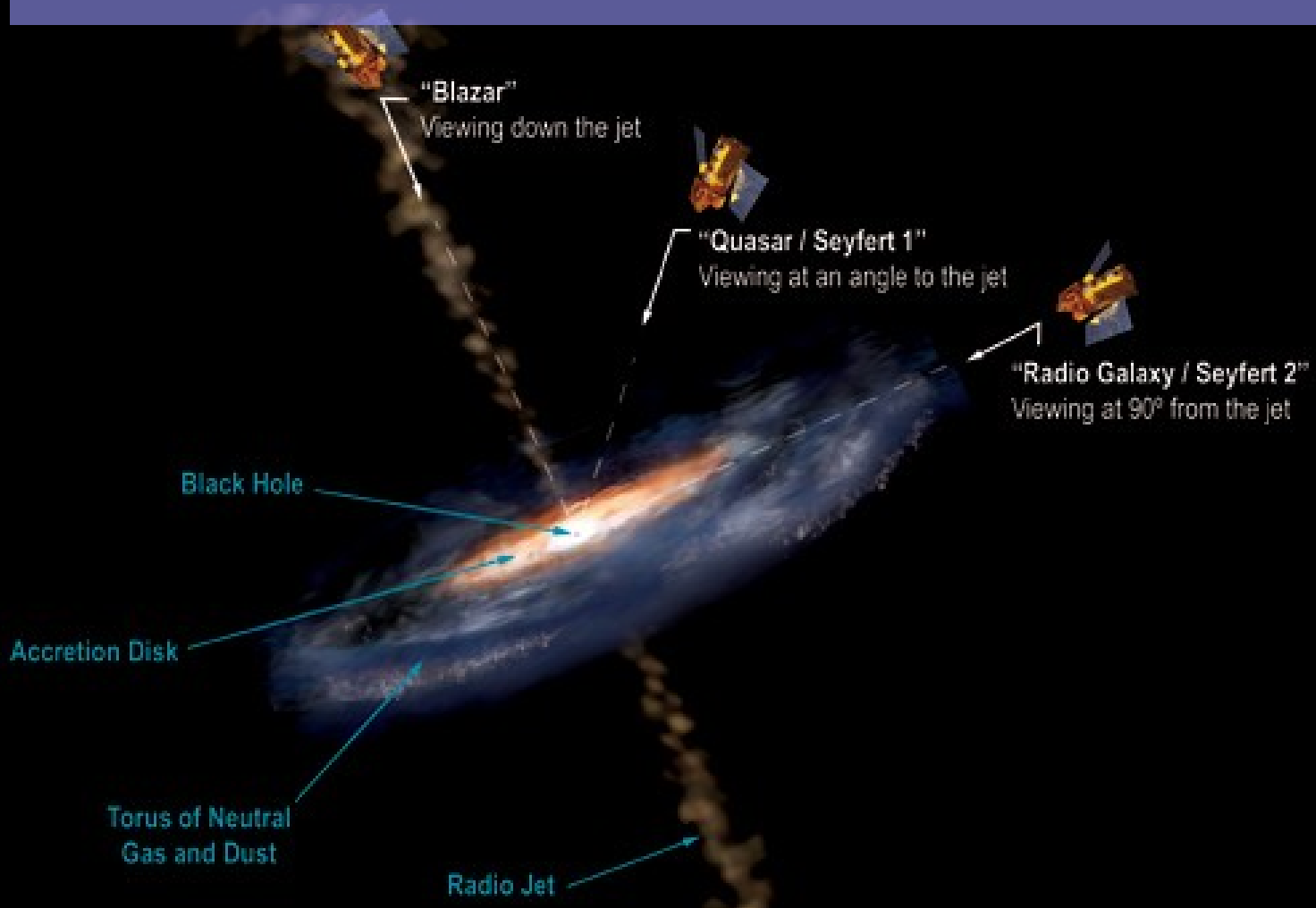


V709 Cas
Cataclysmic Var. DQ Her type

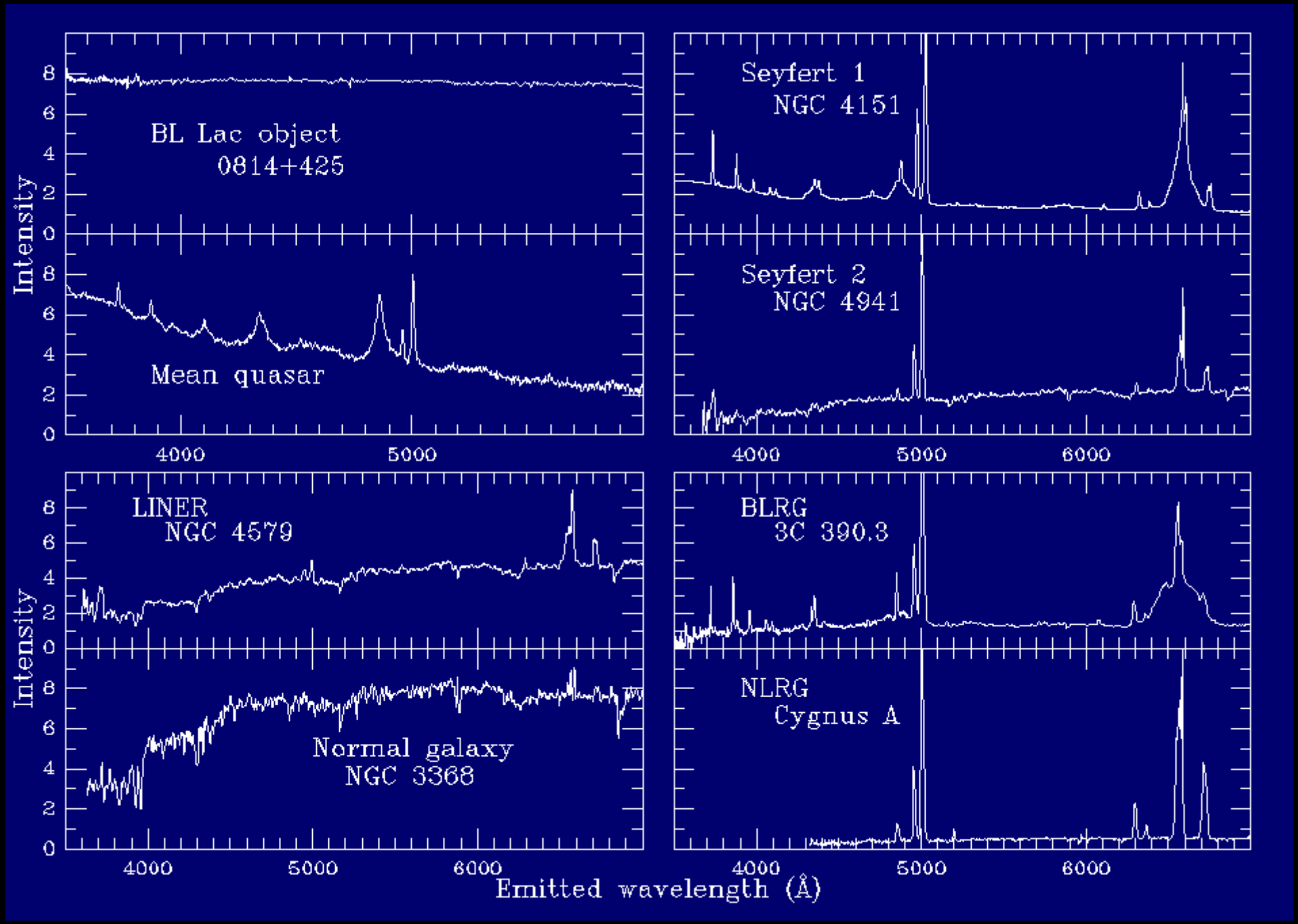


X-ray beasts from far Universe - AGN

The active galactic nucleus (AGN)
is a compact region at the center of a galaxy which has a much higher luminosity than normal over some or all of the electromagnetic spectrum (in the radio, infrared, optical, ultra-violet, X-ray and gamma ray wavebands)

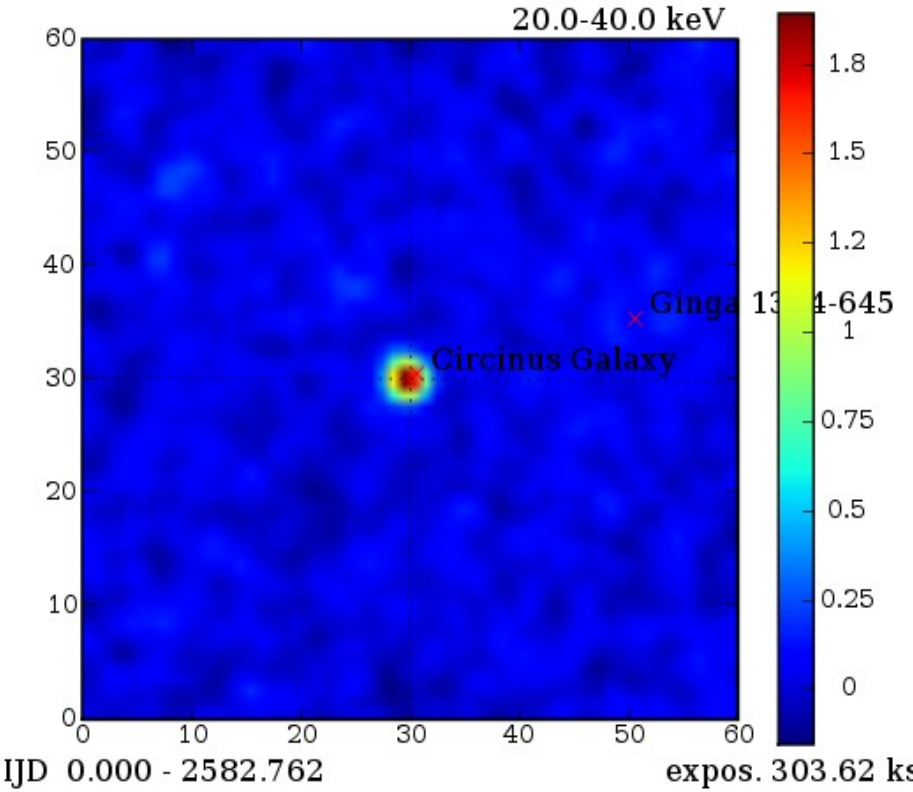


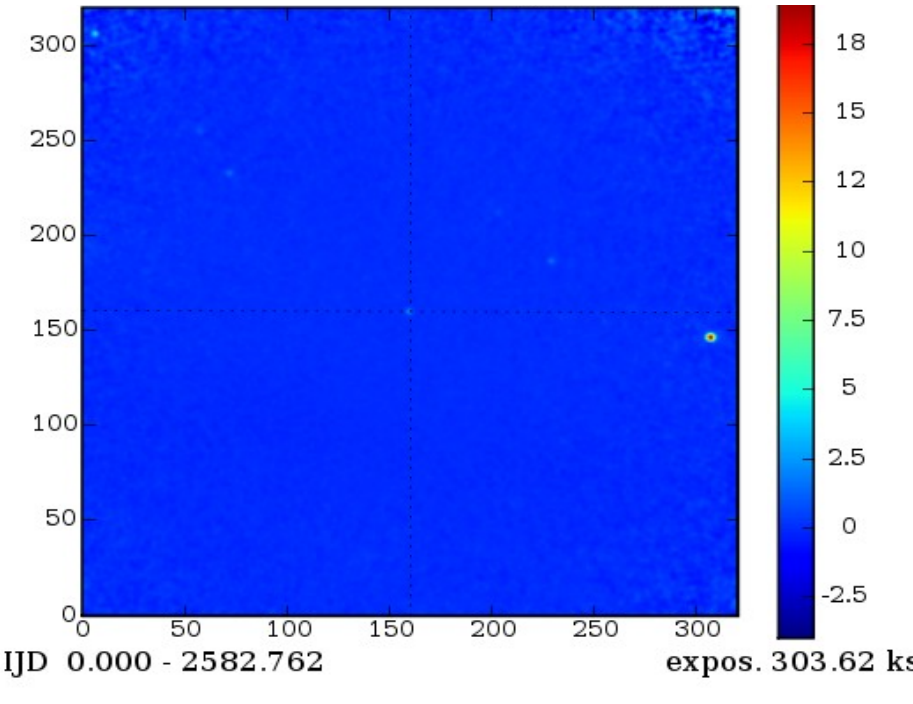
Trieda	Pod-trieda	Popis
Seyfertove galaxie	Typ I	Široké aj úzke emisné čiary, slabá rádiová emisia, rentgenová emisia, špirálové galaxie, zmeny jasnosti
	Typ II	Len úzke emisné čiary, slabá rádiová emisia, slabá rentgenová emisia, špirálové galaxie, nepremenné
Kvasary	Radio-loud (QSR)	Široké aj úzke emisné čiary, silná rádiová emisia, žiarenie polarizované, zmeny jasnosti
	Radio- quiet (QSO)	Široké aj úzke emisné čiary, slabá rádiová emisia, žiarenie slabo polarizované, zmeny jasnosti
Rádiové galaxie	BLRG	Široké aj úzke emisné čiary, silná rádiová emisia, žiarenie slabo polarizované, eliptické galaxie, zmeny jasnosti
	NLRG	Iba úzke emisné čiary, silná rádiová emisia, žiarenie nie je polarizované, eliptické galaxie, bez zmien jasnosti
Blazary	BL Lac	Skoro bez emisných čiar, silná rádiová emisia, žiarenie silne polarizované, rapídne zmeny jasnosti
	OVV kvasary	Široké aj úzke emisné čiary, silná rádiová emisia, žiarenie silne polarizované, rapídne zmeny jasnosti, oveľa jasnejšie ako BL Lac
ULIRG		Kvasary zahalené prachom, starburst fenomény
LINER		Podobné málo svietivým Seyfert II galaxiám, špirálové galaxie, starburst fenomény, HII oblasti

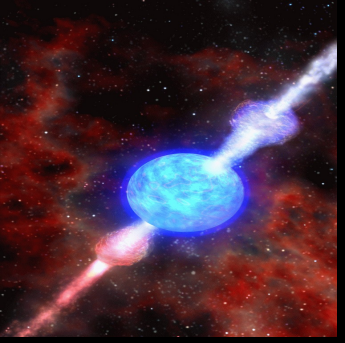

BL Lac object
0814+425
Mean quasar
Seyfert 1
NGC 4151
Seyfert 2
NGC 4941
LINER
NGC 4579
Normal galaxy
NGC 3368
BLRG
3C 390.3
NLRG
Cygnus A
Intensity
Intensity
Emitted wavelength (Å)
0
2
4
6
8
4000
5000
6000

Circinus Galaxy **Hubble Space Telescope • WFPC2**

NASA and A. Wilson (University of Maryland) • STScI-PRC00-37





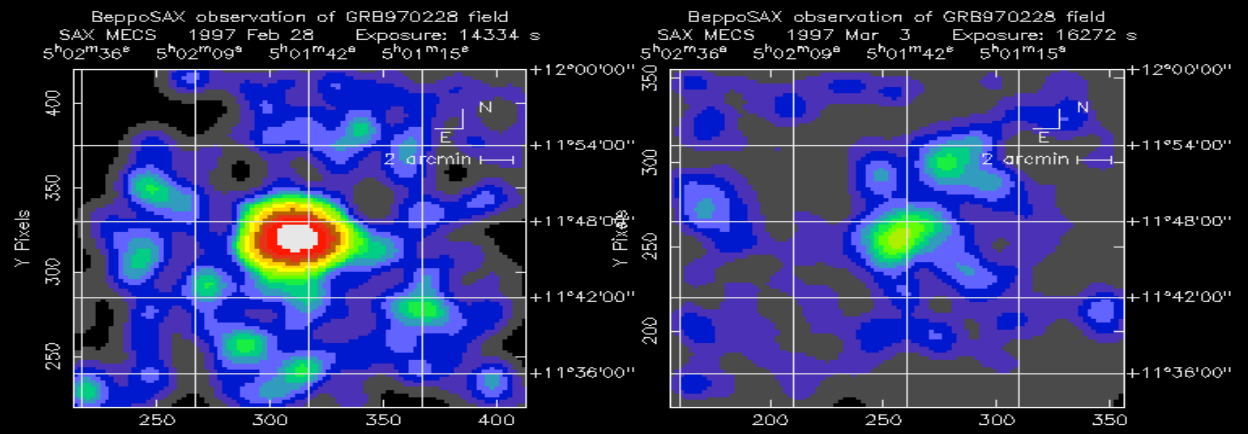


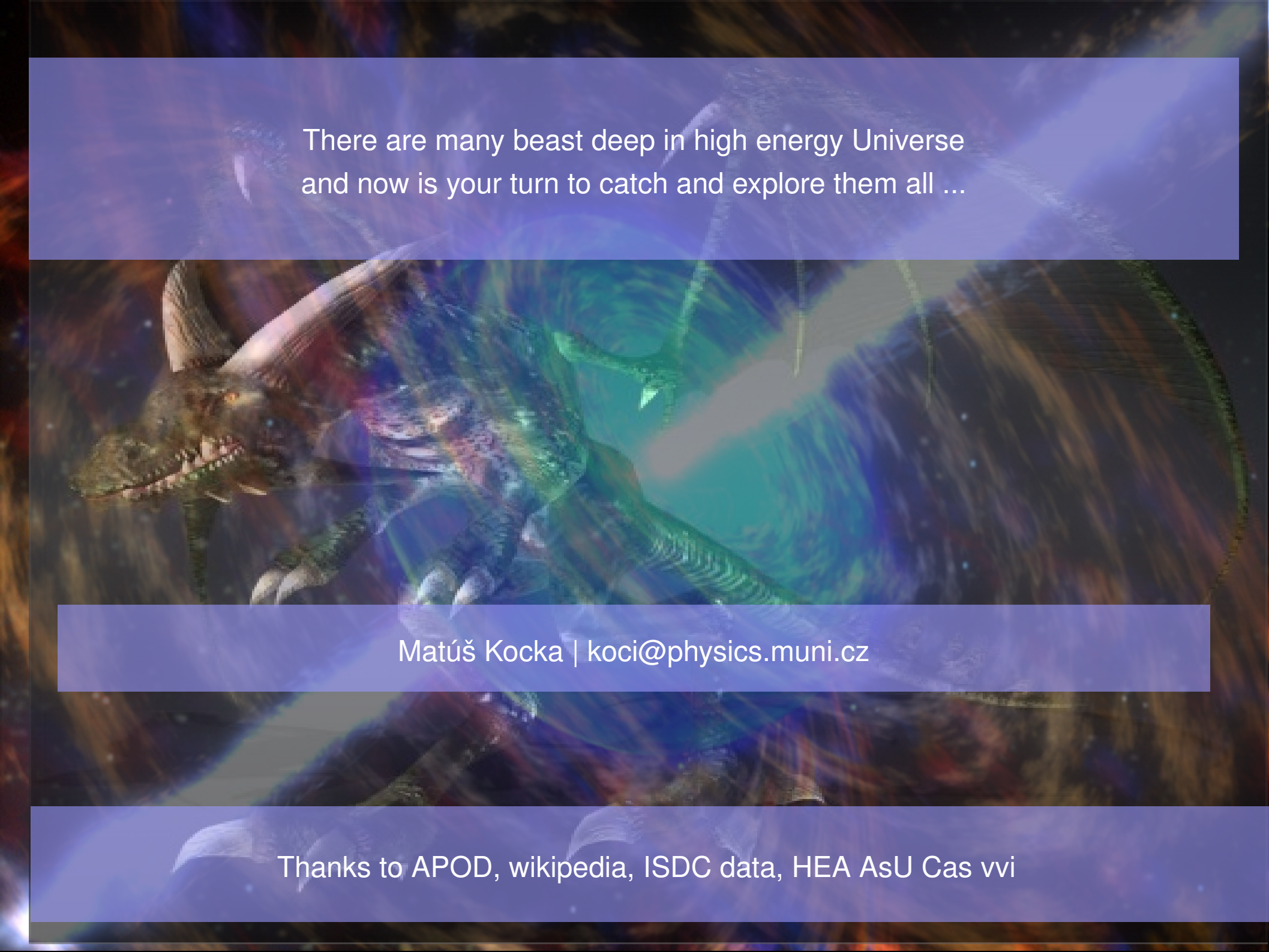
X-ray 'flare" beasts

There are many kinds of flare beasts in far Universe,
such as **supernovas** (**Ia**, **Ib**, **Ic** and **II**),
GMR – Giant Magnetar Flares *(really mysterious things)* and
GRB – Gamma ray bursts

GRBs are most luminous objects ever observed in whole universe.
There are two main classes of GRBs : short *(< 2 sec)* & long durations flares in gamma.

Long durations GRBs *(more than 2 sec)* belongs to
fatality of old, very big star called **Colapsar**
Short GRBs probably belongs to merge of neutron stars or
something like that ?





There are many beast deep in high energy Universe
and now is your turn to catch and explore them all ...

Matúš Kocka | koci@physics.muni.cz

Thanks to APOD, wikipedia, ISDC data, HEA AsU Cas vvi