GALACTIC TRANSIENTS WITH SVOM

J. Rodriguez ,W. Yu & S.N. Zhang

GALACTIC SOURCES

A large number of different types

- X-ray Binaries the obvious candidates

  + Swift and INTEGRAL : CV (IP) are > 20 keV emitters !

  + What about γ-ray binaries (bulk of emission at VHE, high mass companion)?

- Isolated sources: WD/novae, neutron stars (incl. SGR and AXPs giant flares and bursts)

  + Swift and INTEGRAL: magnetically active stars also > 20 keV emitters

THE PHYSICS

Different families/sources => large number of key scientific questions (multi-λ and multi-instr. obs.)

- XRBs & CVs: physics of accretion (DIM, outburst mechanisms, state transitions,…) and links with jets/winds (energetic budget, particle acceleration, ISM feedback)
- γRBs & VHE emitters: Leptonic vs. hadronic model (synergy with CTA), interaction with secondary
- NS & WD: B topology, reconnection mechanisms and NS-quake, thermonuclear burning/explosions, crustal cooling, EOS (together with timing studies)
- Stars: Flare mechanisms, B in solar types stars, particle acceleration and impact on ISM

GALACTIC SOURCES BY SVOM OBSERVATIONS

☑ X-ray Monitoring (roughly comparable to Swift/BAT)
need extra attention to Galactic Bulge and Plane if GRBs will be detected at a rate of 60+/yr

☑ Sufficient ToO time (more non-GRB ToOs are expected)
a substantial amount of ToOs would be on Galactic sources

☑ Will be benefited from ground wide field-of-view surveys
e.g., SKA in radio, zPTF and PanSStars in optical, CTA at VHE, LIGO, etc.

Thermal emission black body: soft X-rays ~1keV

MXT

Jet emission: radio to IR/ Optical

GFT/GWAC/VT

(External) disc/companion: IR - Visible

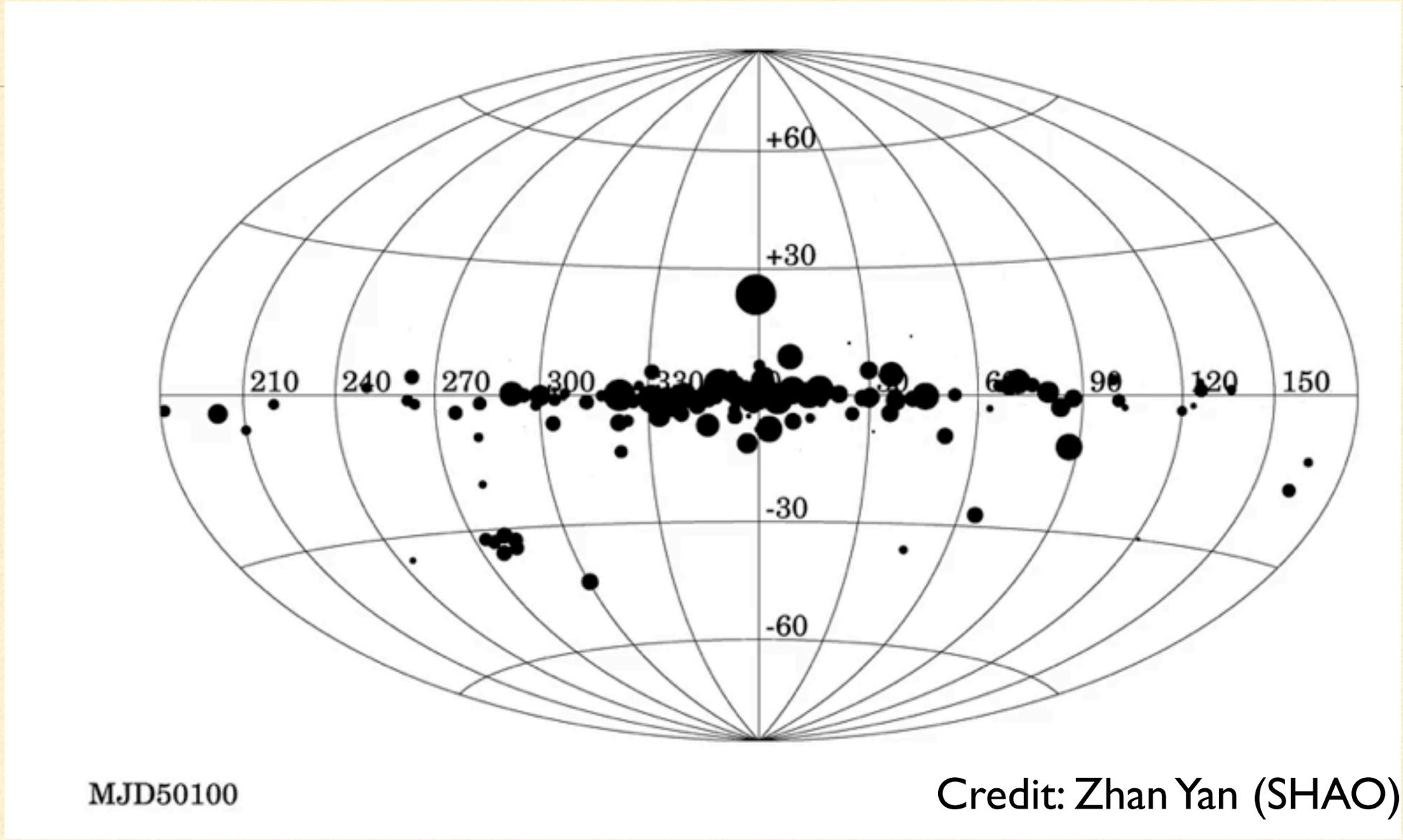
ECLAIRS

Hard X-ray (10-200 keV): « Corona »

GRM

γ-ray emission 0.2-10 MeV: Origin?

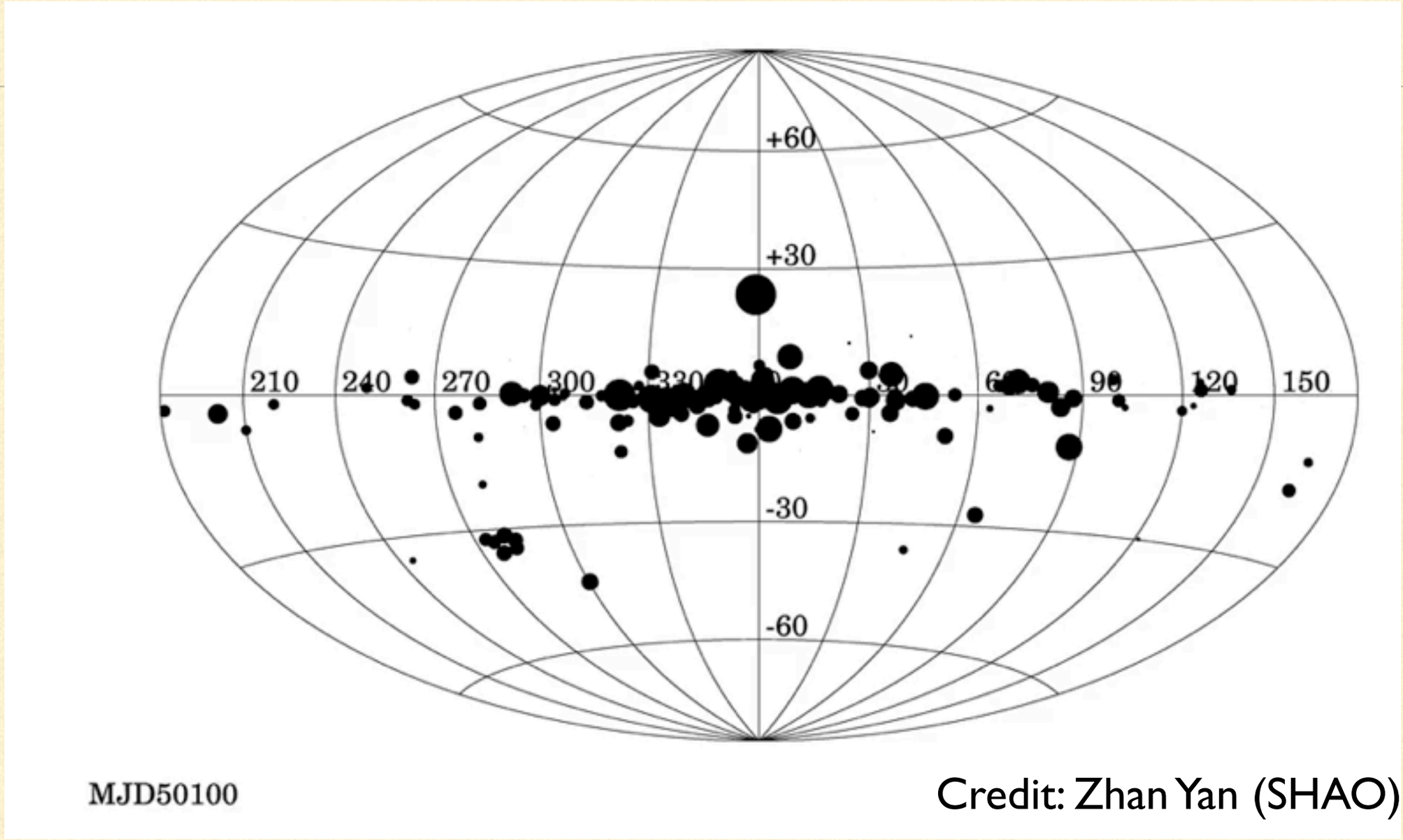
SOFT X-RAY TRANSIENT OUTBURSTS LABORATORY FOR ACCRETION PHYSICS



Credit: Zhan Yan (SHAO)

RXTE/ASM: 16 years all sky monitoring of the X-ray sky

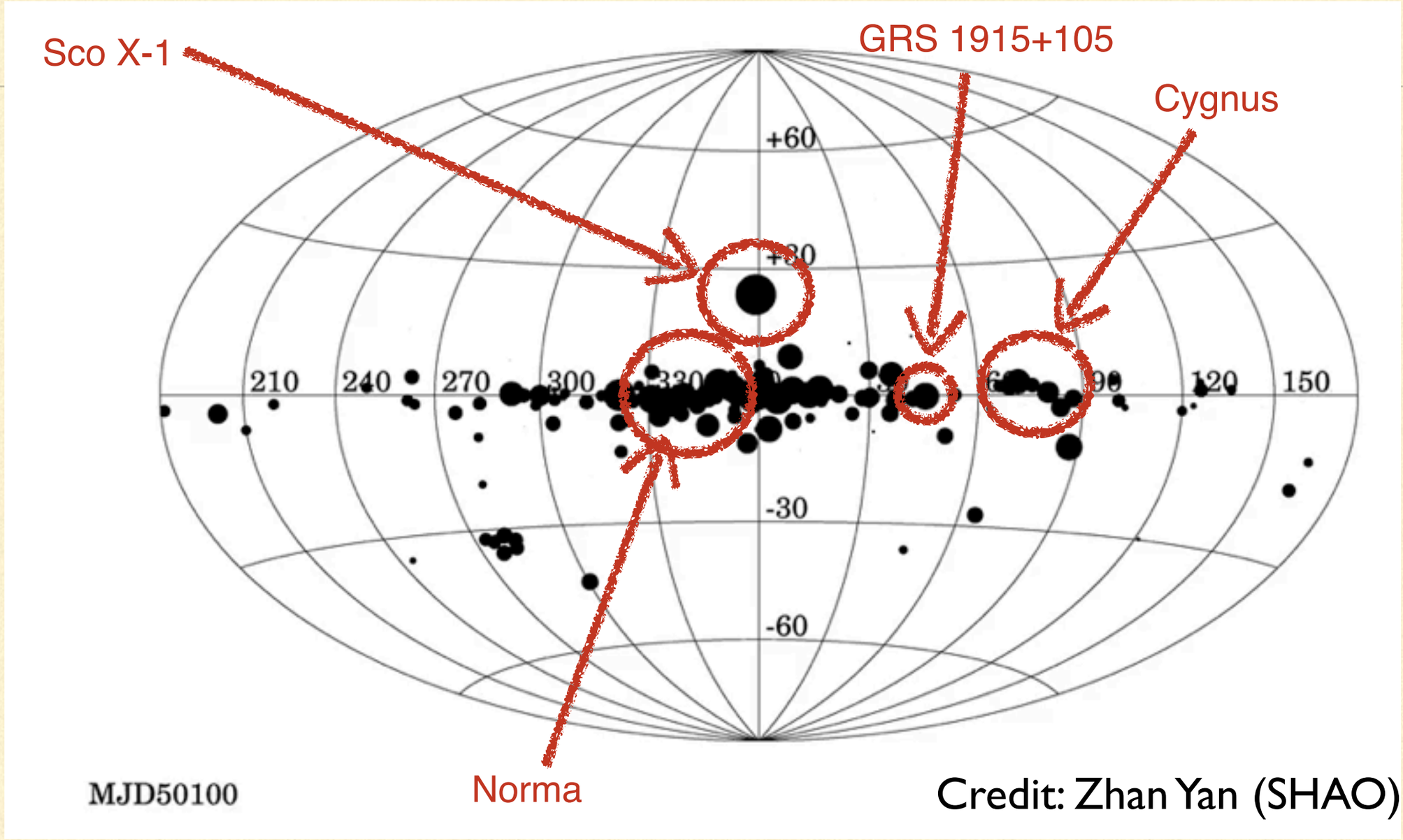
SOFT X-RAY TRANSIENT OUTBURSTS LABORATORY FOR ACCRETION PHYSICS



Credit: Zhan Yan (SHAO)

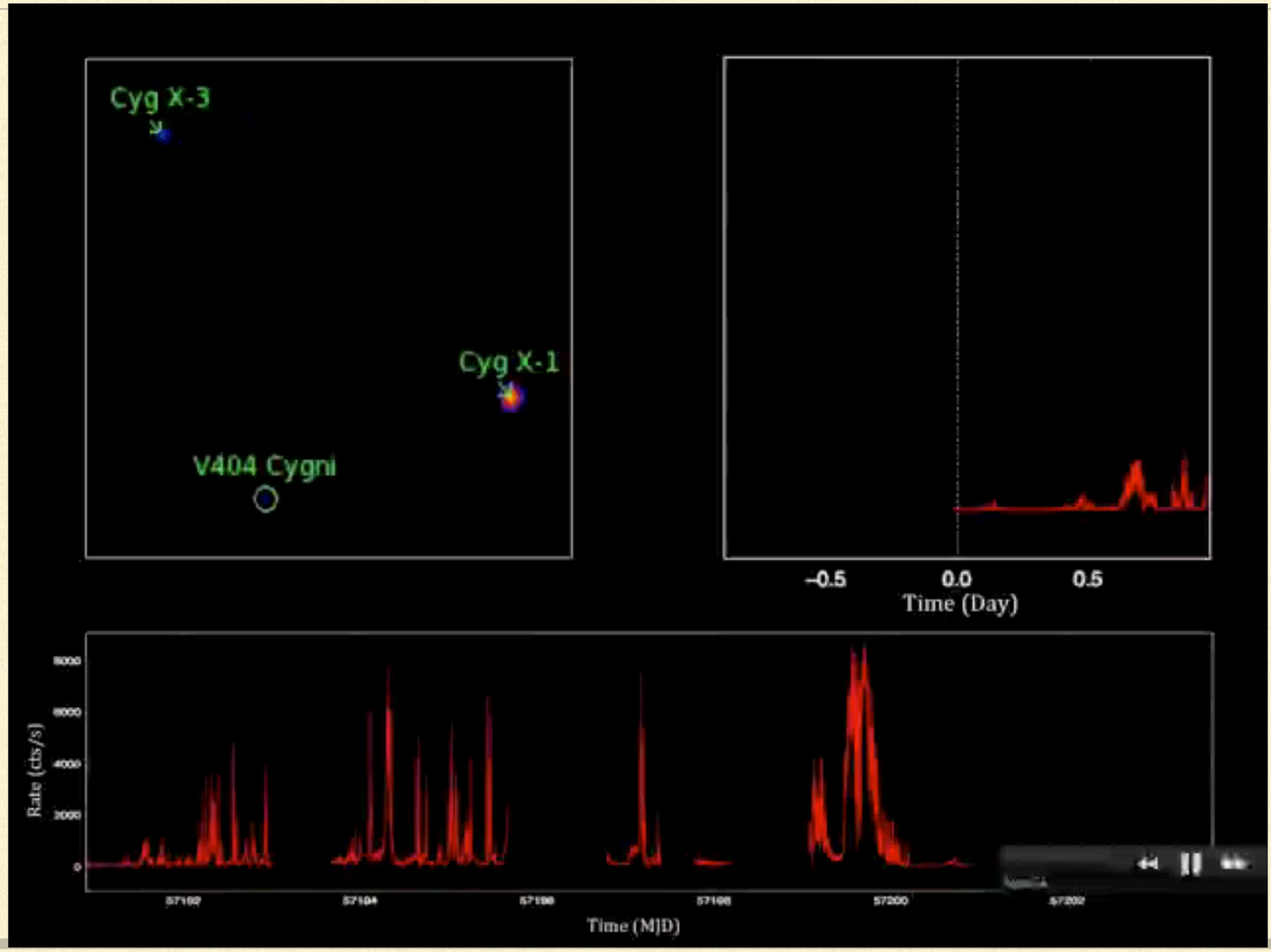
RXTE/ASM: 16 years all sky monitoring of the X-ray sky

SOFT X-RAY TRANSIENT OUTBURSTS LABORATORY FOR ACCRETION PHYSICS

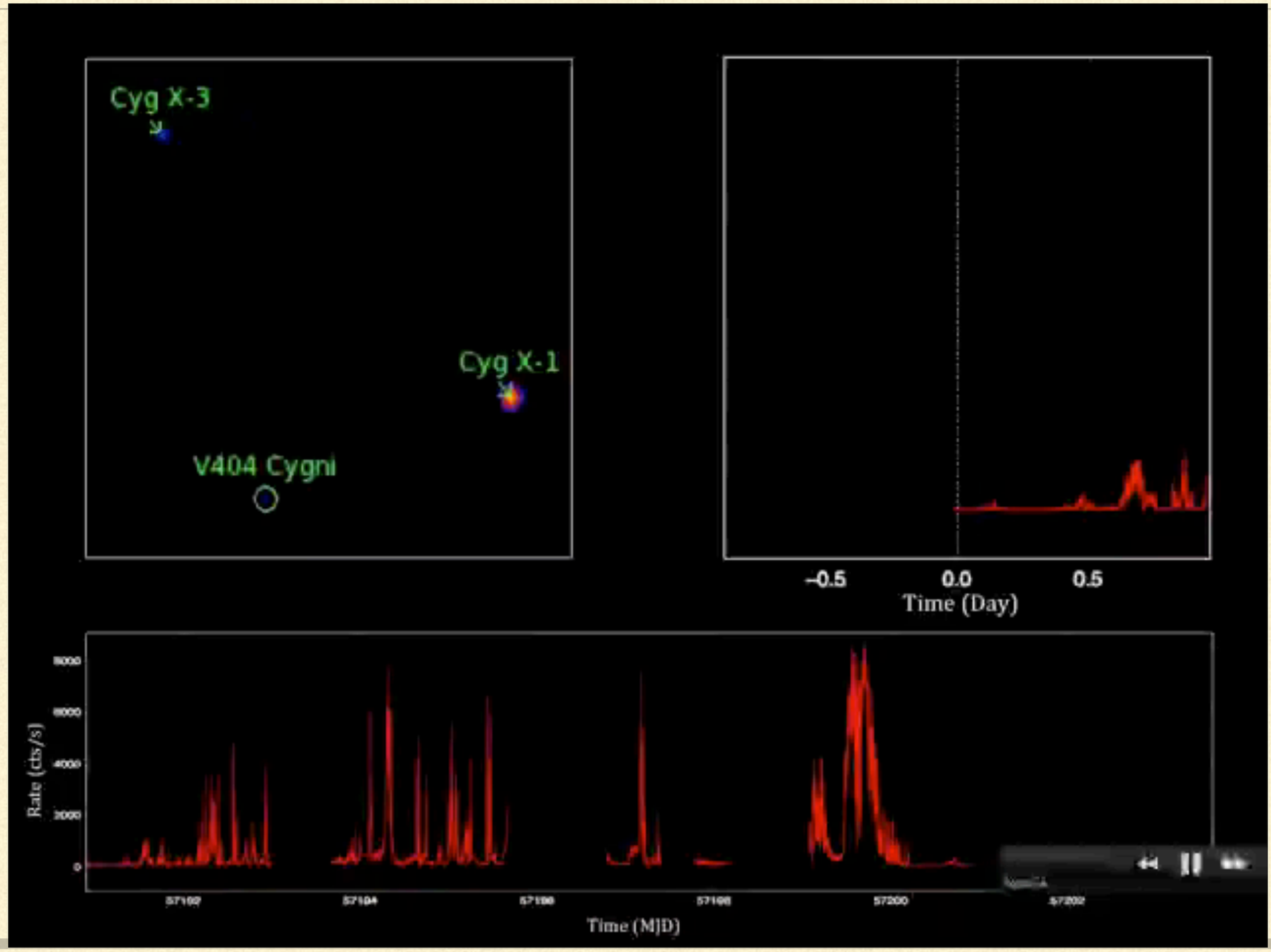


RXTE/ASM: 16 years all sky monitoring of the X-ray sky

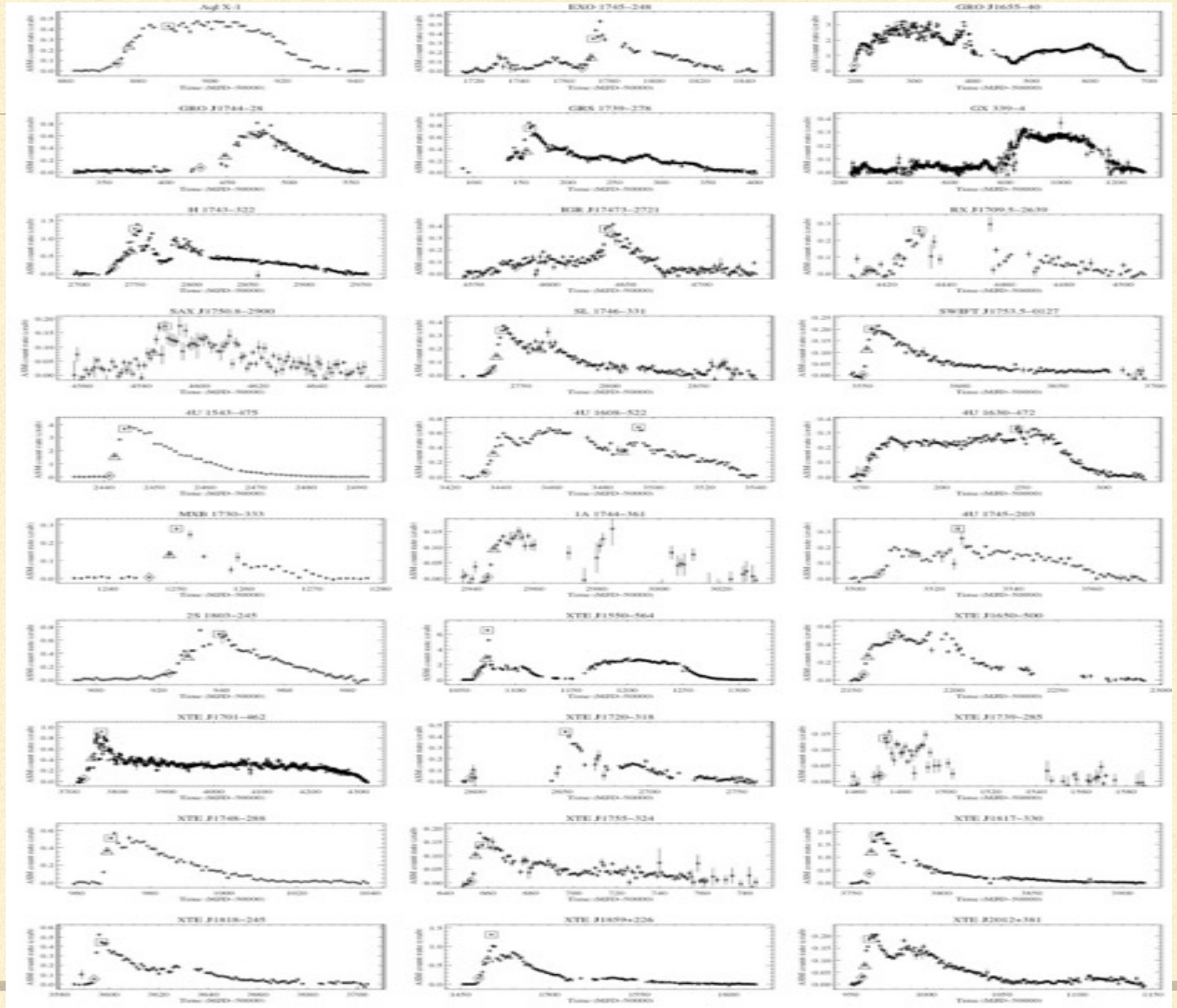
IMAGING: DISCOVERING SOURCES / DETECTING CHANGES



IMAGING: DISCOVERING SOURCES / DETECTING CHANGES

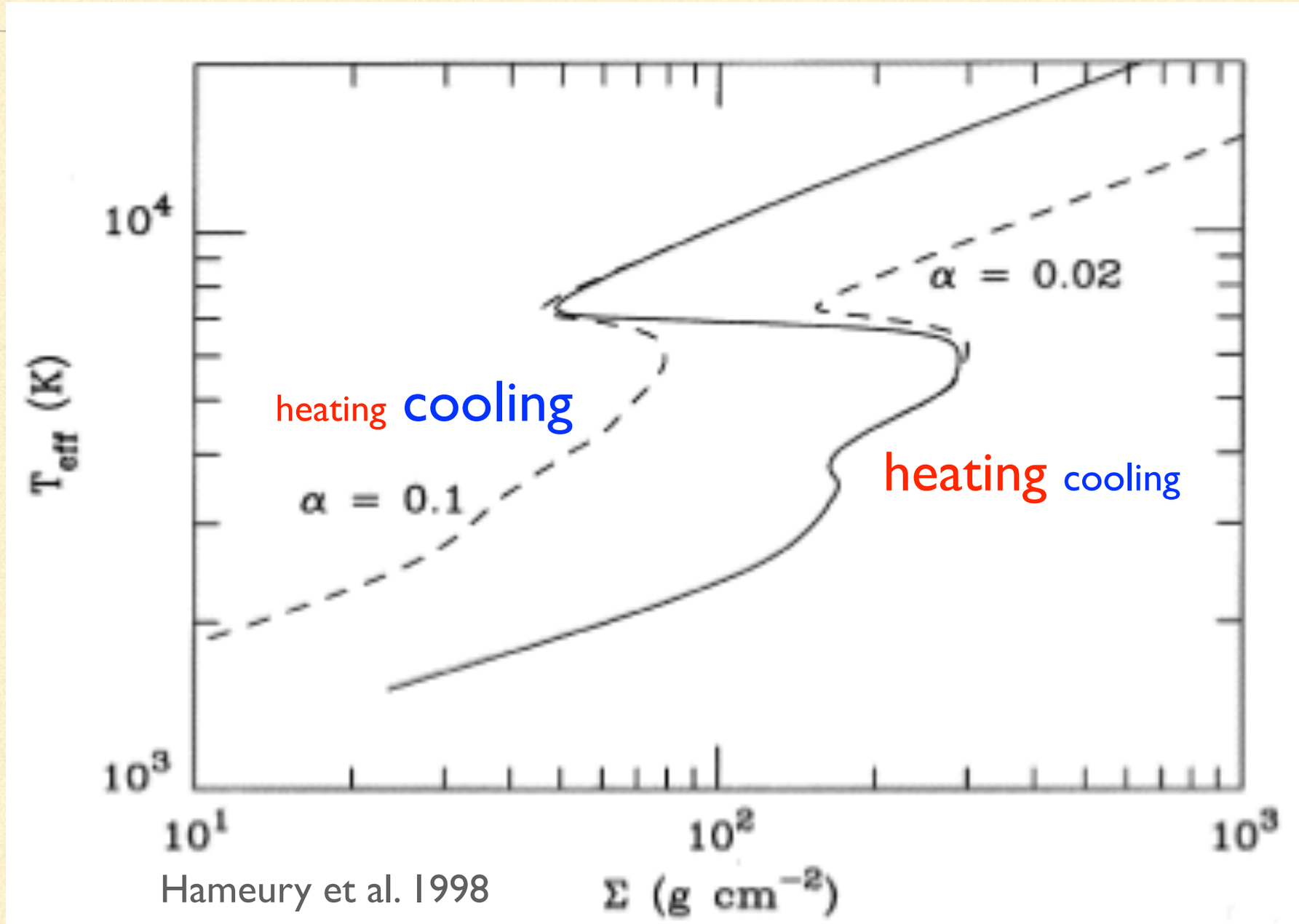


OUTBURSTS AND PROFILES



Yan & Yu 2015

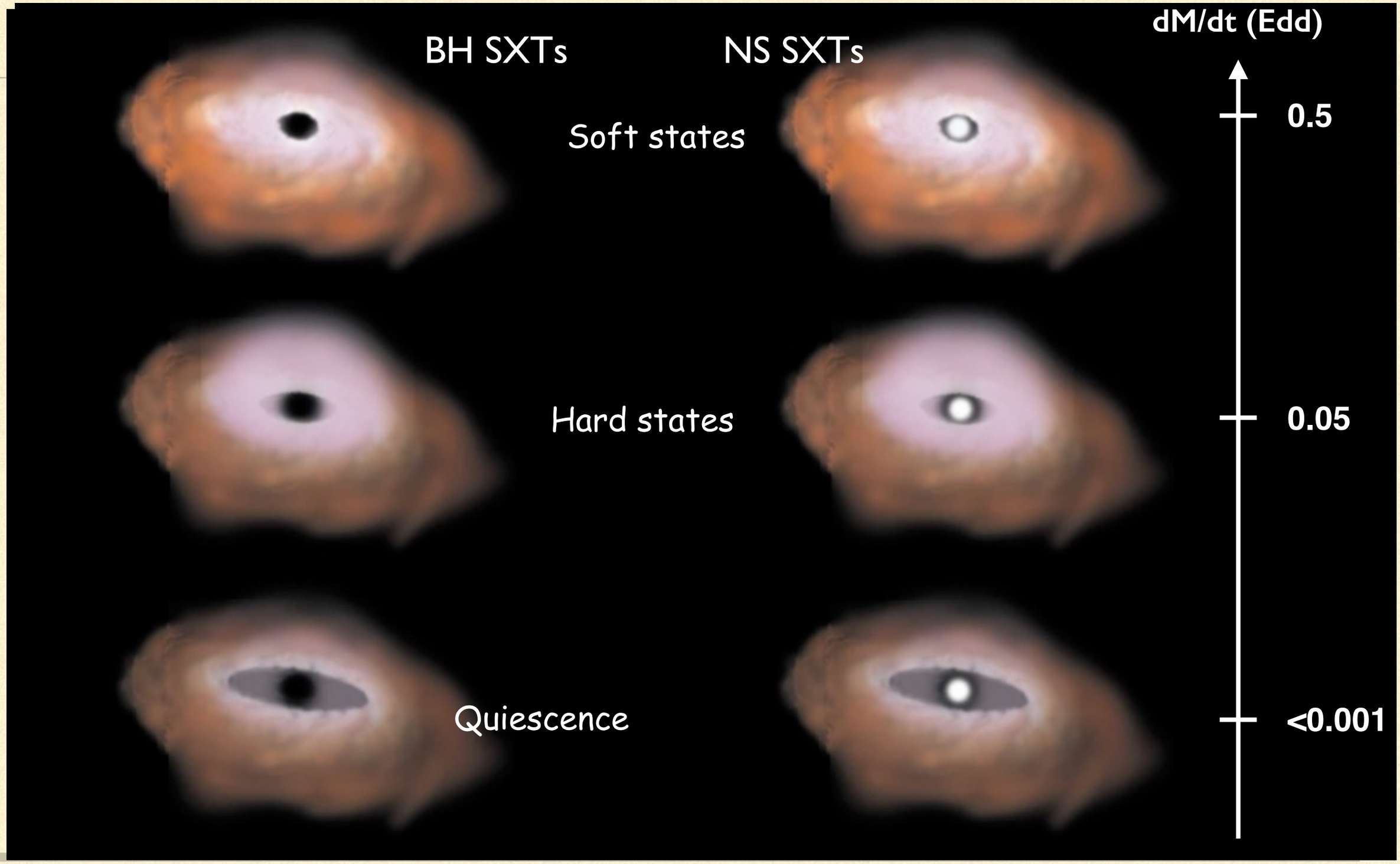
ACCRETION SCIENCE I: PLASMA PHYSICS & DISK INSTABILITY



Hameury et al. 1998

understanding viscosity parameter in accretion flows

ACCRETION SCIENCE 2: PHYSICS OF STATE TRANSITIONS



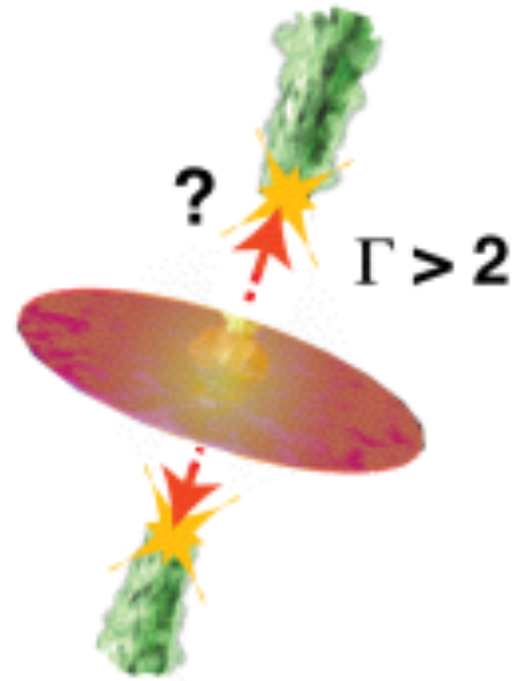
e.g. Esin et al. 1997

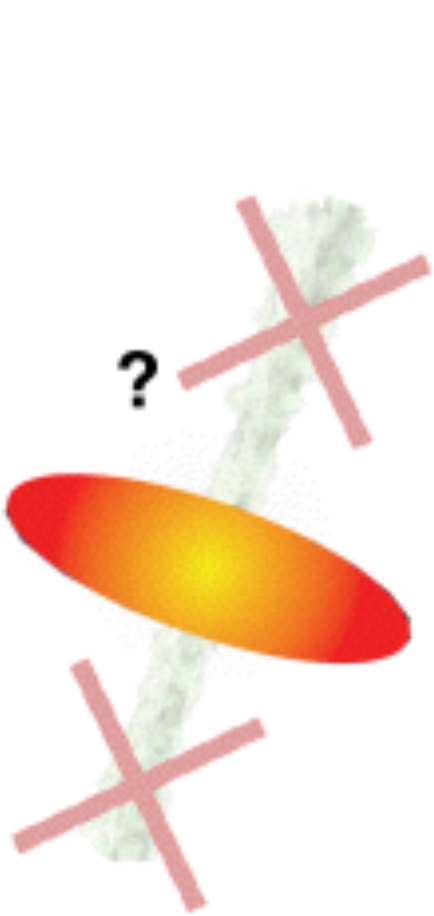
Not an easy game

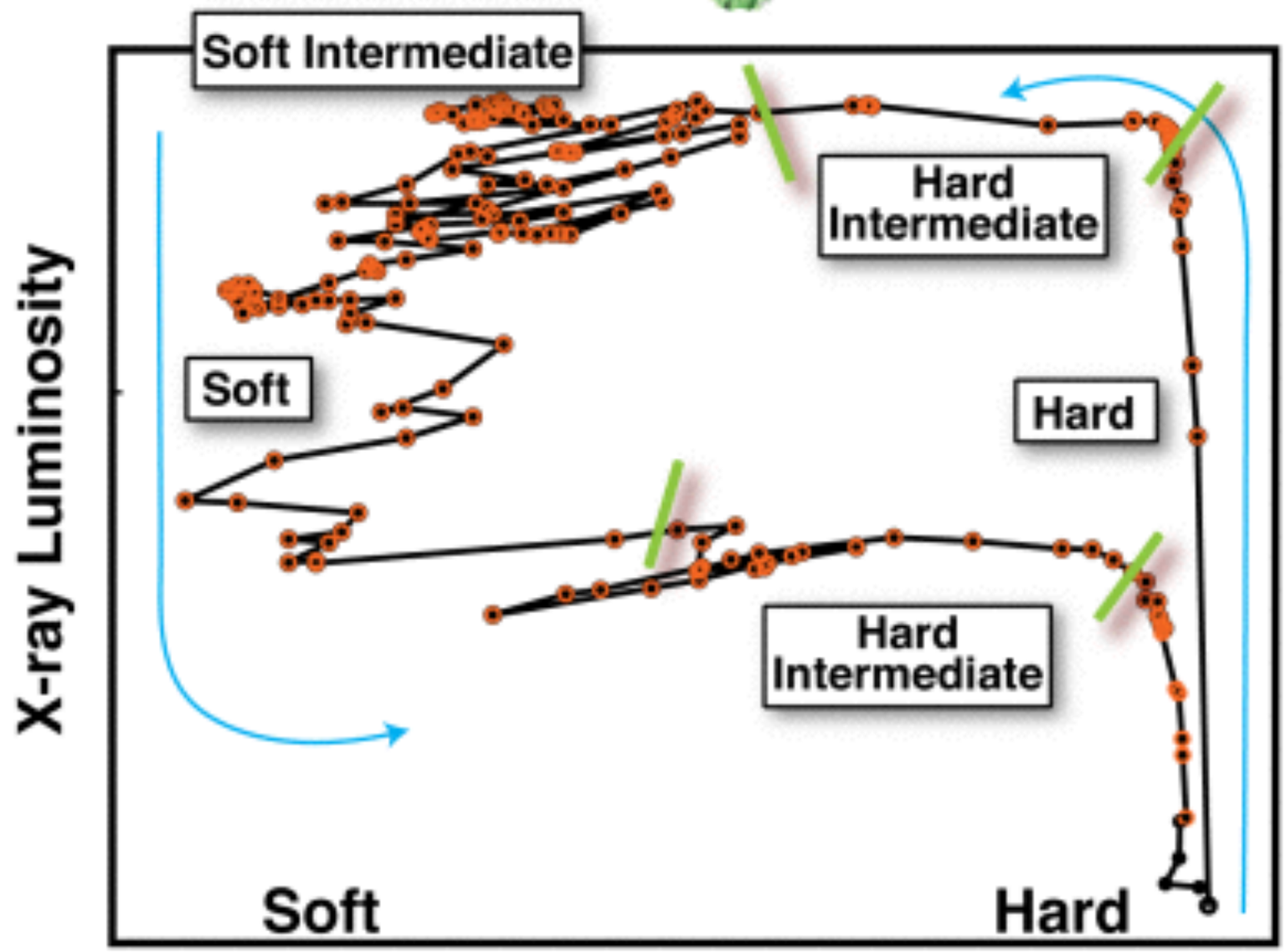
=> additional param to dot(m) (*eg.* Yu & Yan 09)

=> link with jets/winds

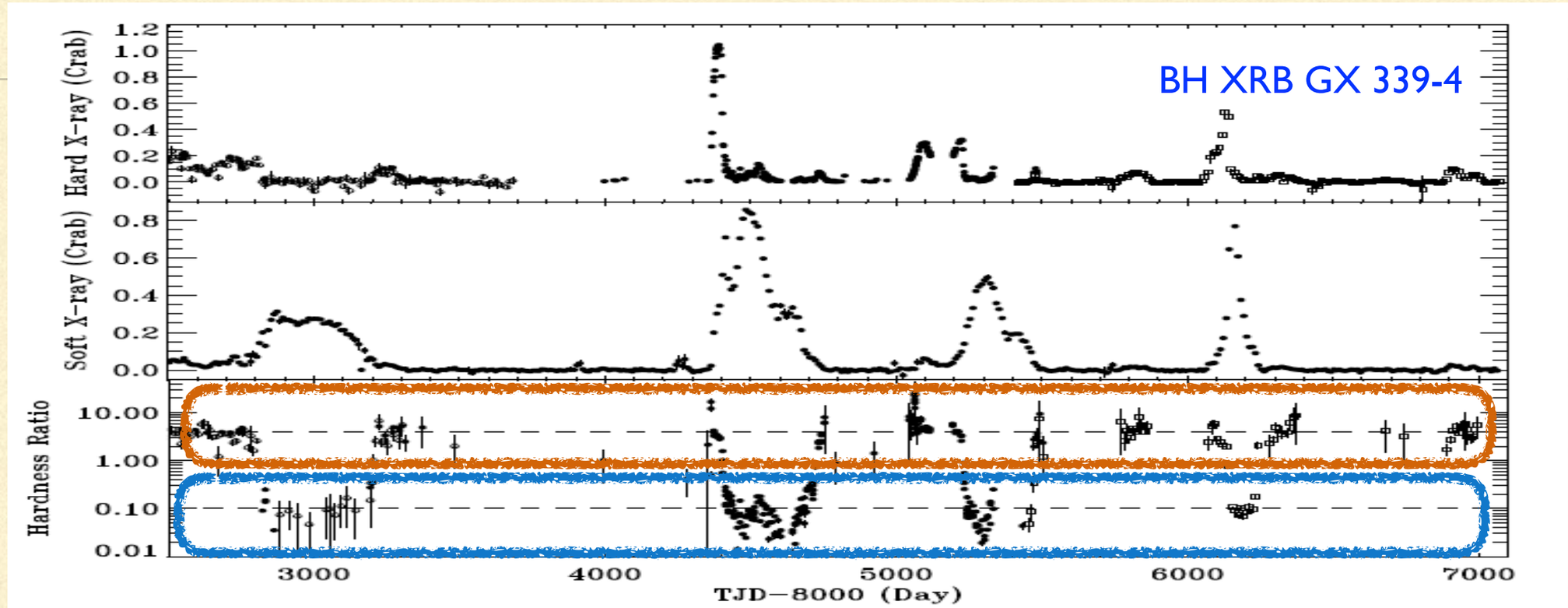
=> and the fast variability (QPO)?

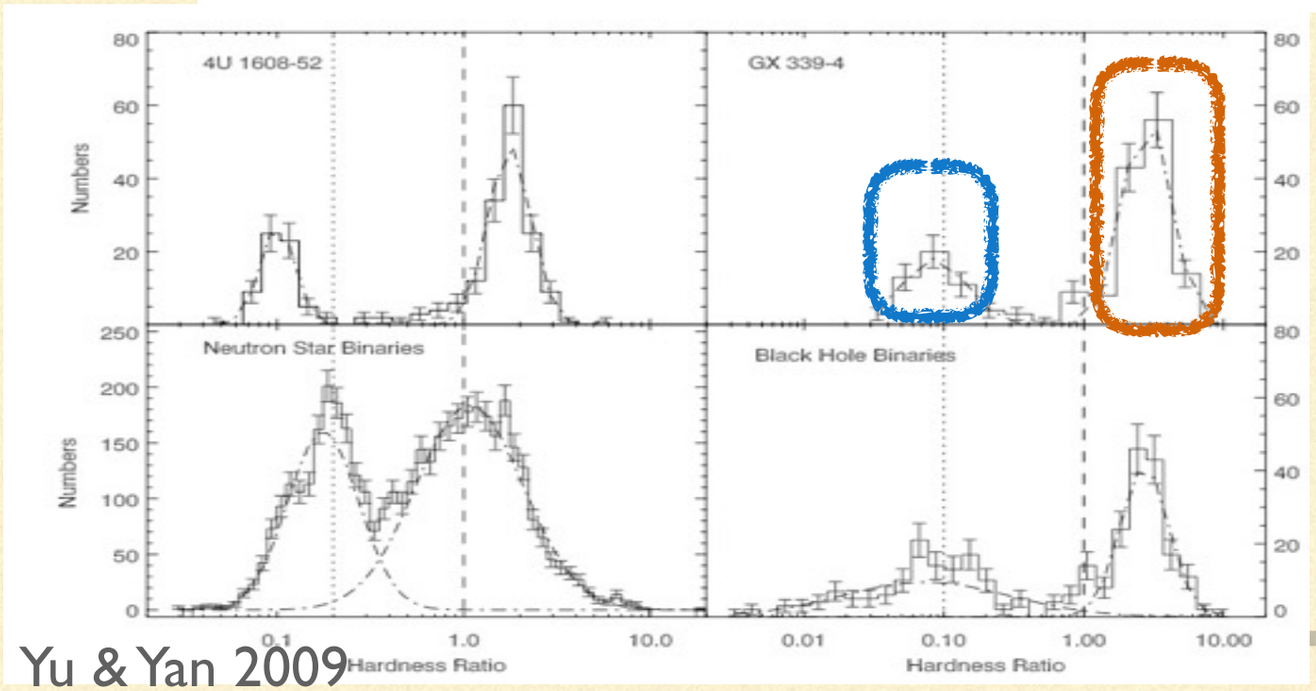






THE SITUATION IS NOT THAT BAD

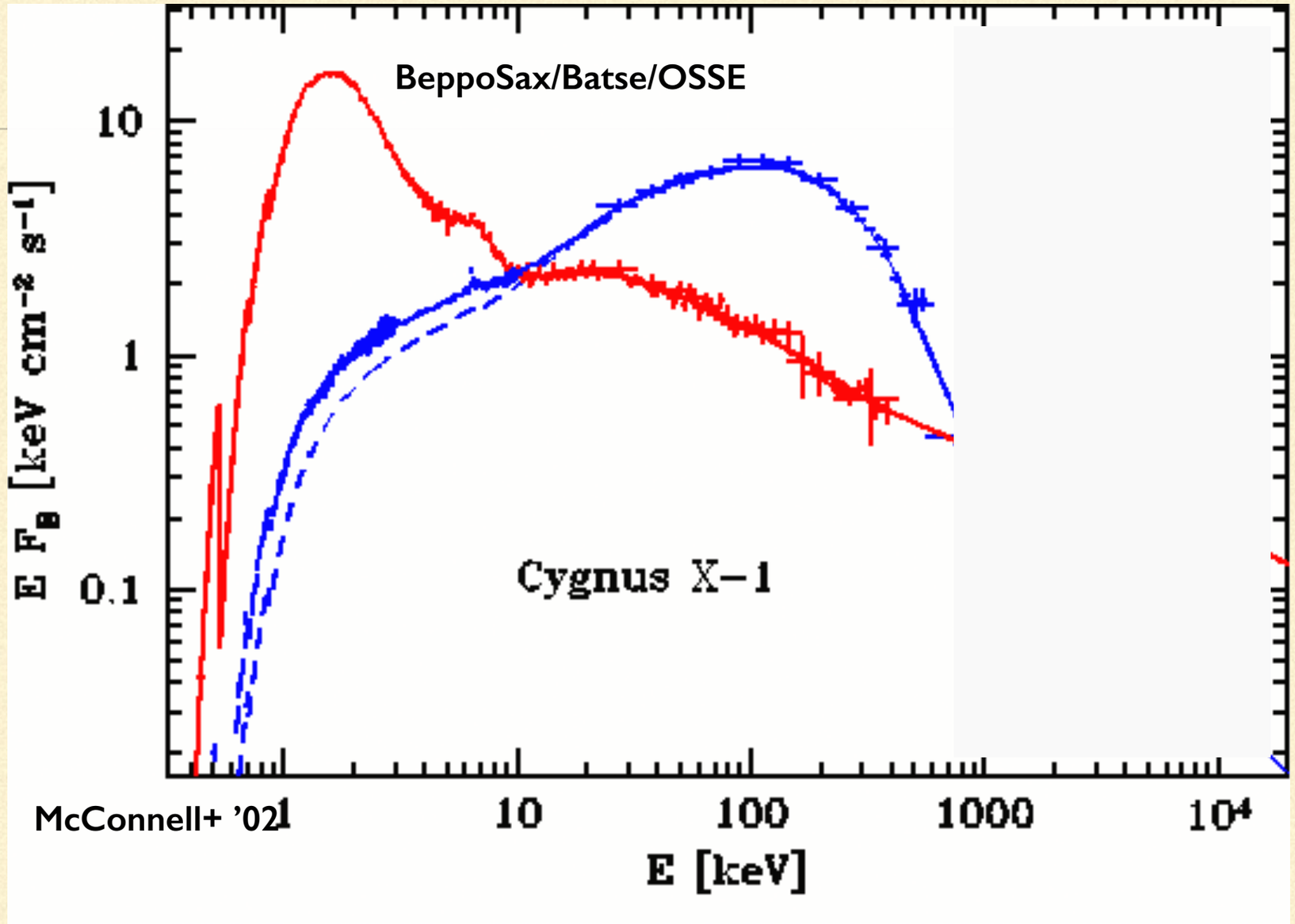




Yu & Yan 2009

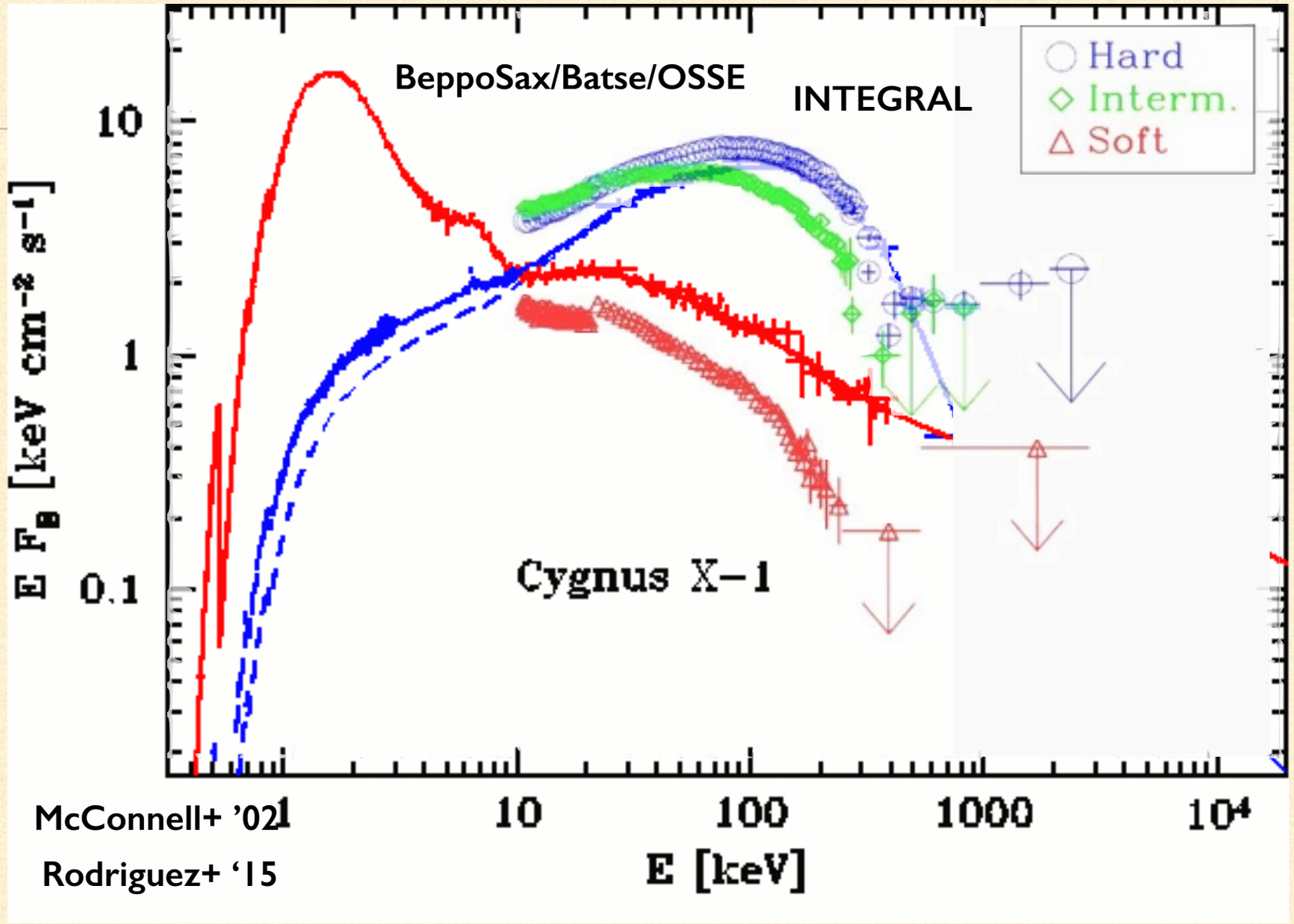
Real bimodal behaviour
Easy to separate
=> time resolved spectroscopy

SPECTRAL ANALYSIS OF SOFT VS HARD STATES



McConnell+ ’02

SPECTRAL ANALYSIS OF SOFT VS HARD STATES



McConnell+ ’02

Rodriguez+ ‘15

SPECTRAL ANALYSIS OF SOFT VS HARD STATES

=> Accretion geometry

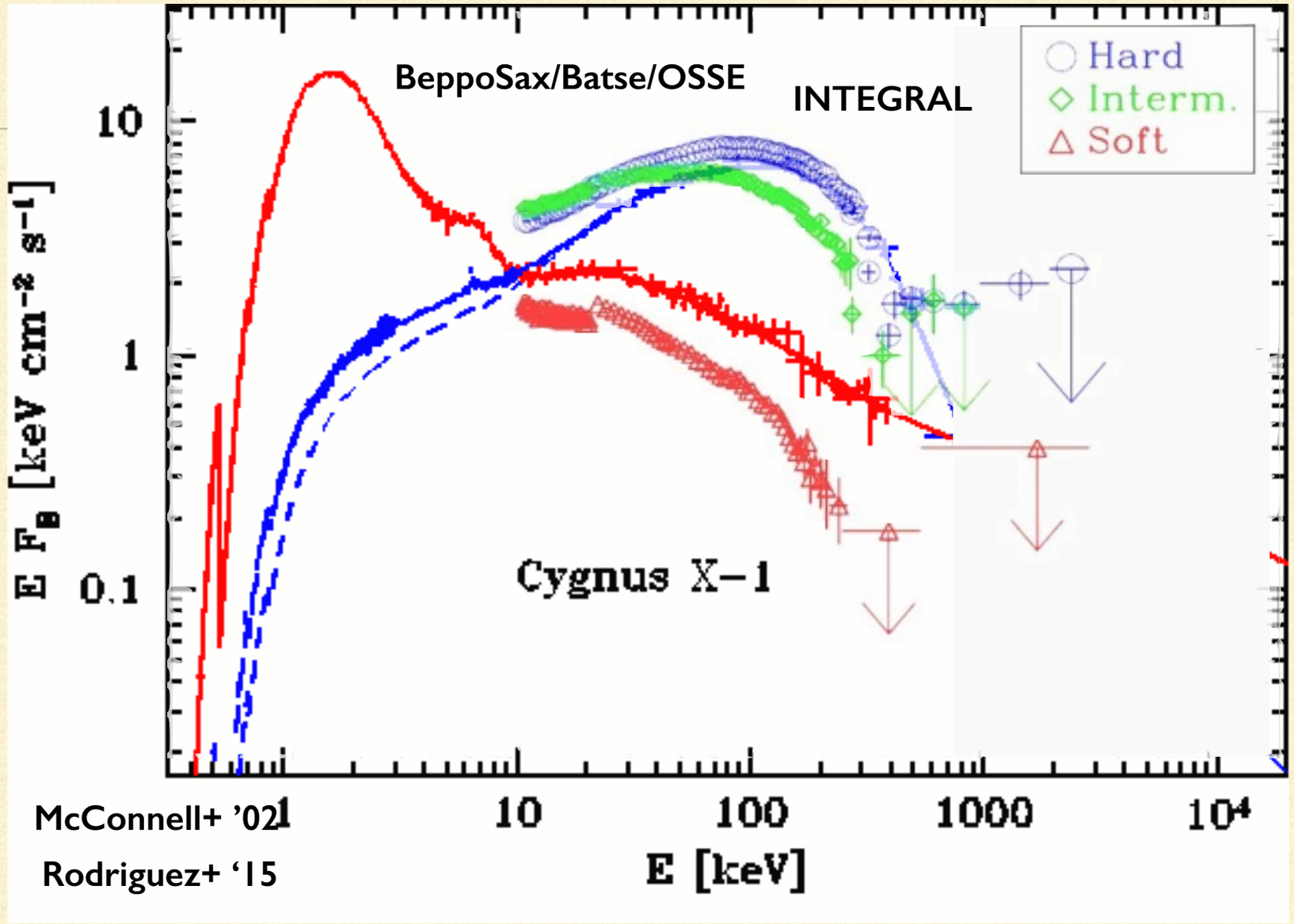
=>Origin of spectral components

=>(fast) Variability

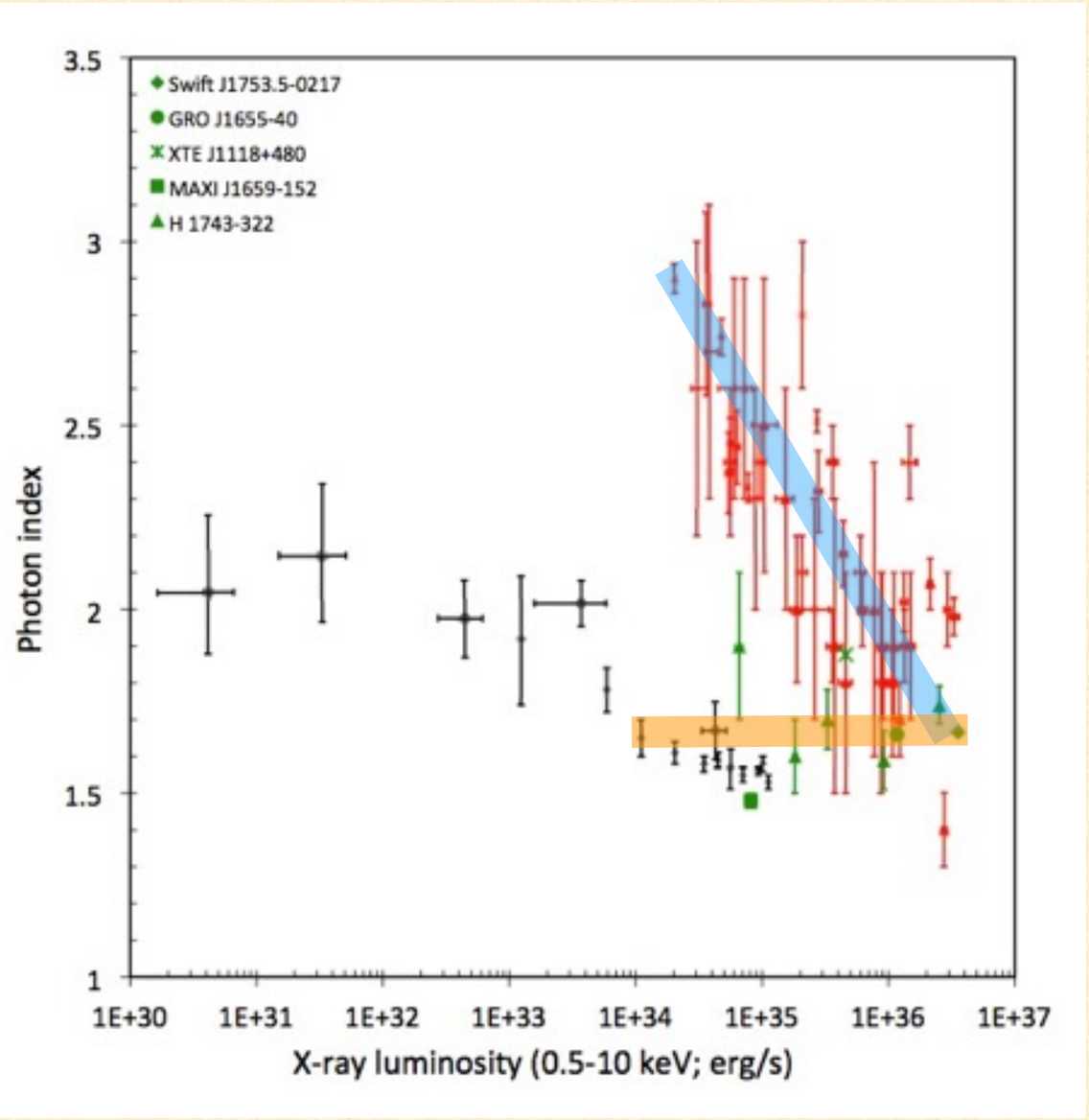
=>Disk-jet coupling (multi-λ)

=>Spin and parameters of CO

=>B of NS



ACCRETION 3: XRBS AT LOW LEVEL



Wijnands et al. 2015

- NS and BH XRBs behave differently in terms of X-ray spectra and their relation to the X-ray luminosity:

- Discriminate between BH and NS transients through X-ray observations

- Origin of the spectral shape vs. X-ray luminosity relation:
  hot accretion flow vs. NS surface emission

- What is the nature of radio vs X-ray emission at these low levels?

=> SKA (and precursors) + SVOM

FEASIBILITY (1): CVS

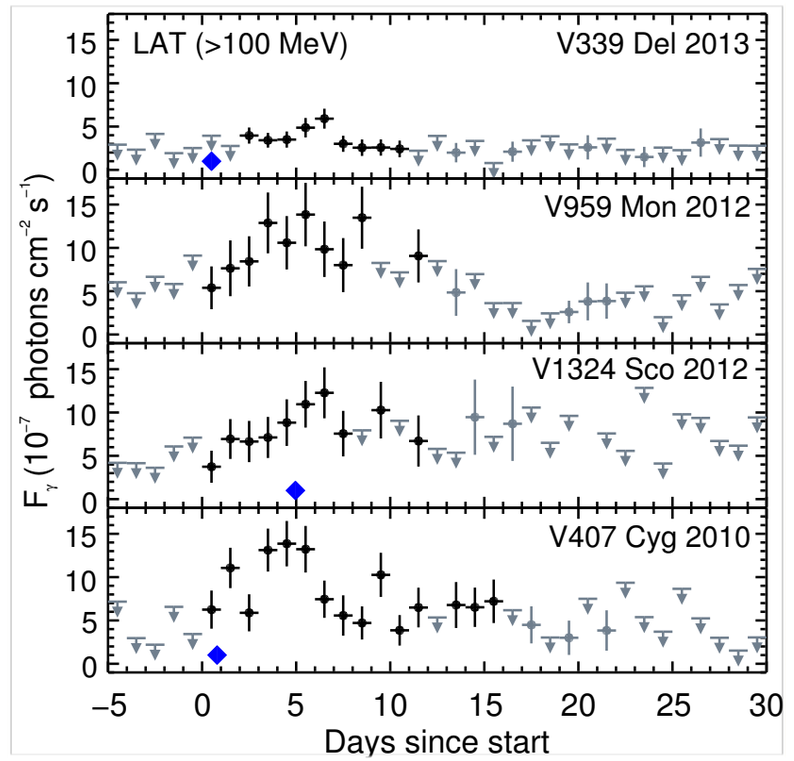
- Nice enough to lie at high b !

=> no constraints due to B1 law

e.g. TW Pic, J17303-0601, and J19552+004 at resp. b~ +13°○, b~+15°○ and b~-13°

- Bright enough to be seen/followed by all instruments onboard from the R band to 50-100 keV

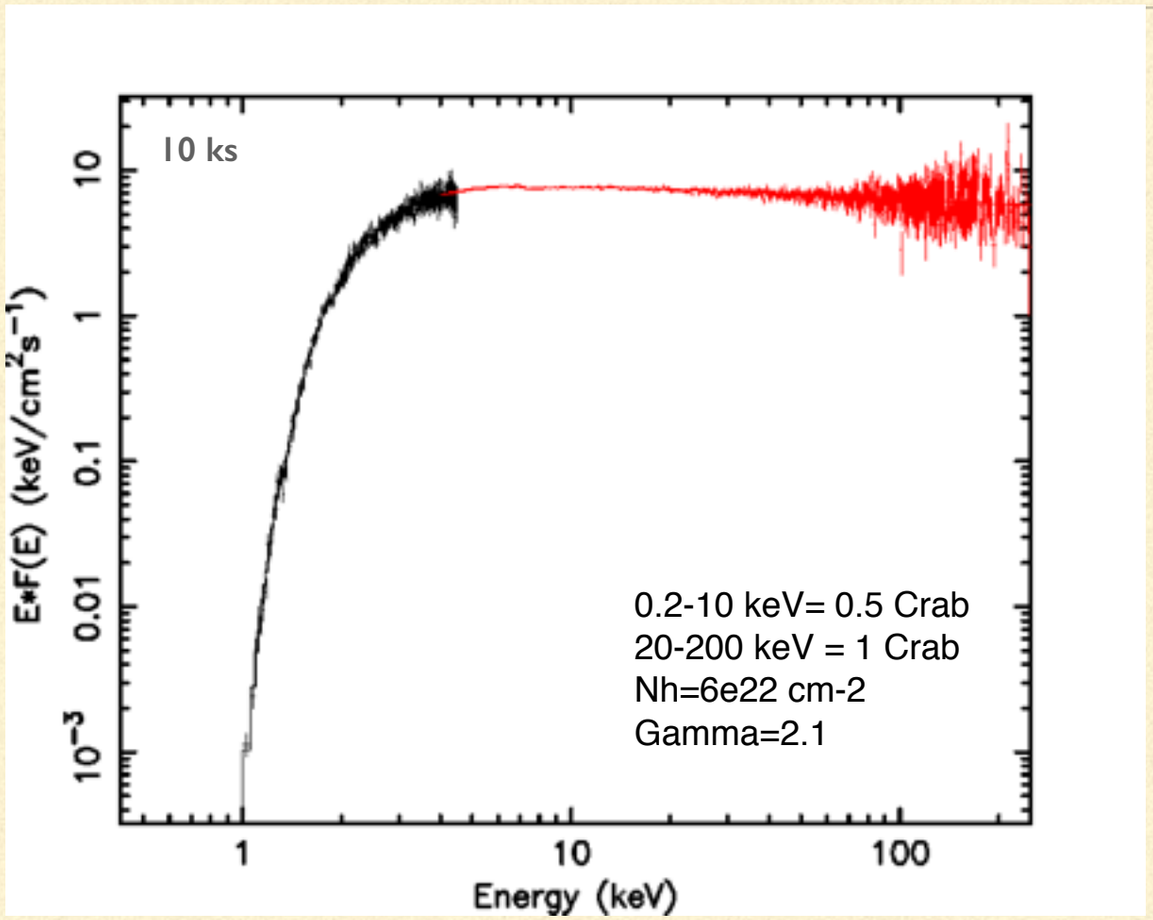
- Large ECLAIRs/GRM fov to detect serendipitous activity: new outbursts or Nova type activity => in synergy with other obs. (e.g. VHE as some have recently been detected with Fermi)



FEASIBILITY (2): XRBS AND ISOLATED NS

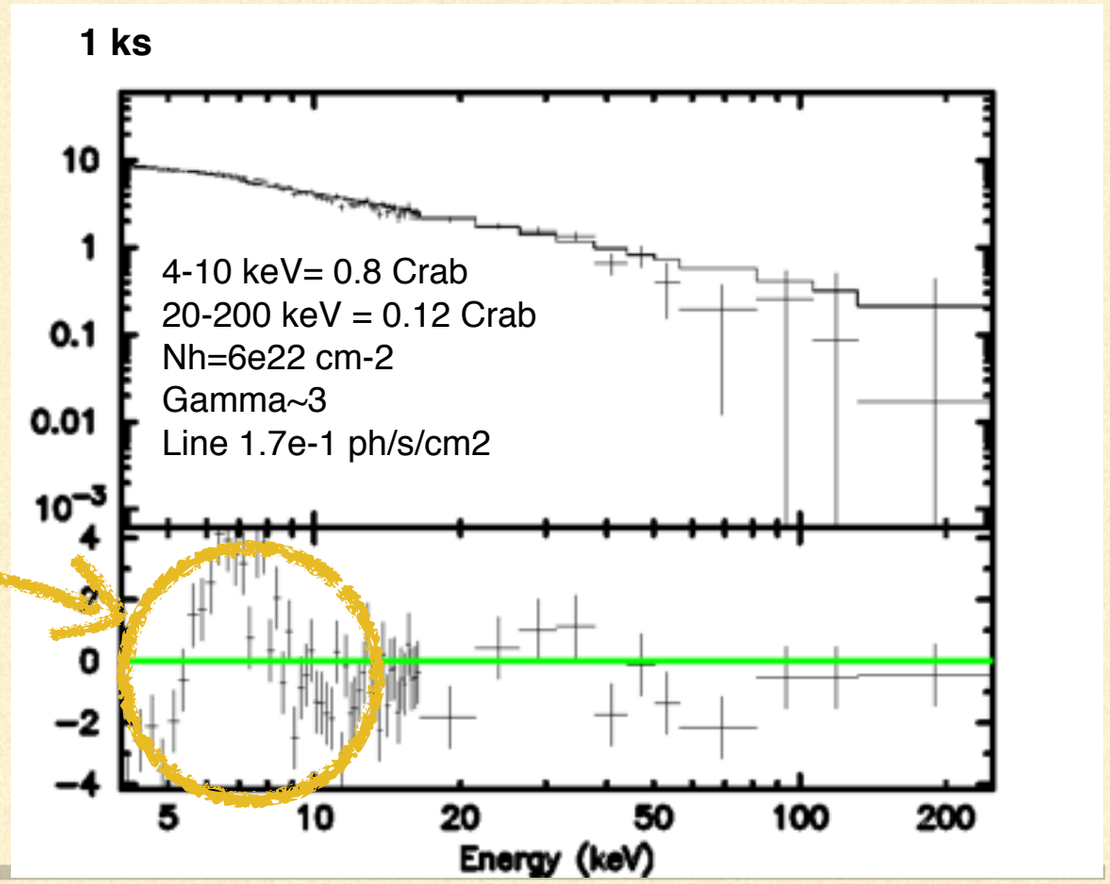
Pre requisite: Be (in the 10% time) outside the B1 law !

THE « EASY » CASES BRIGHT HARD STATES

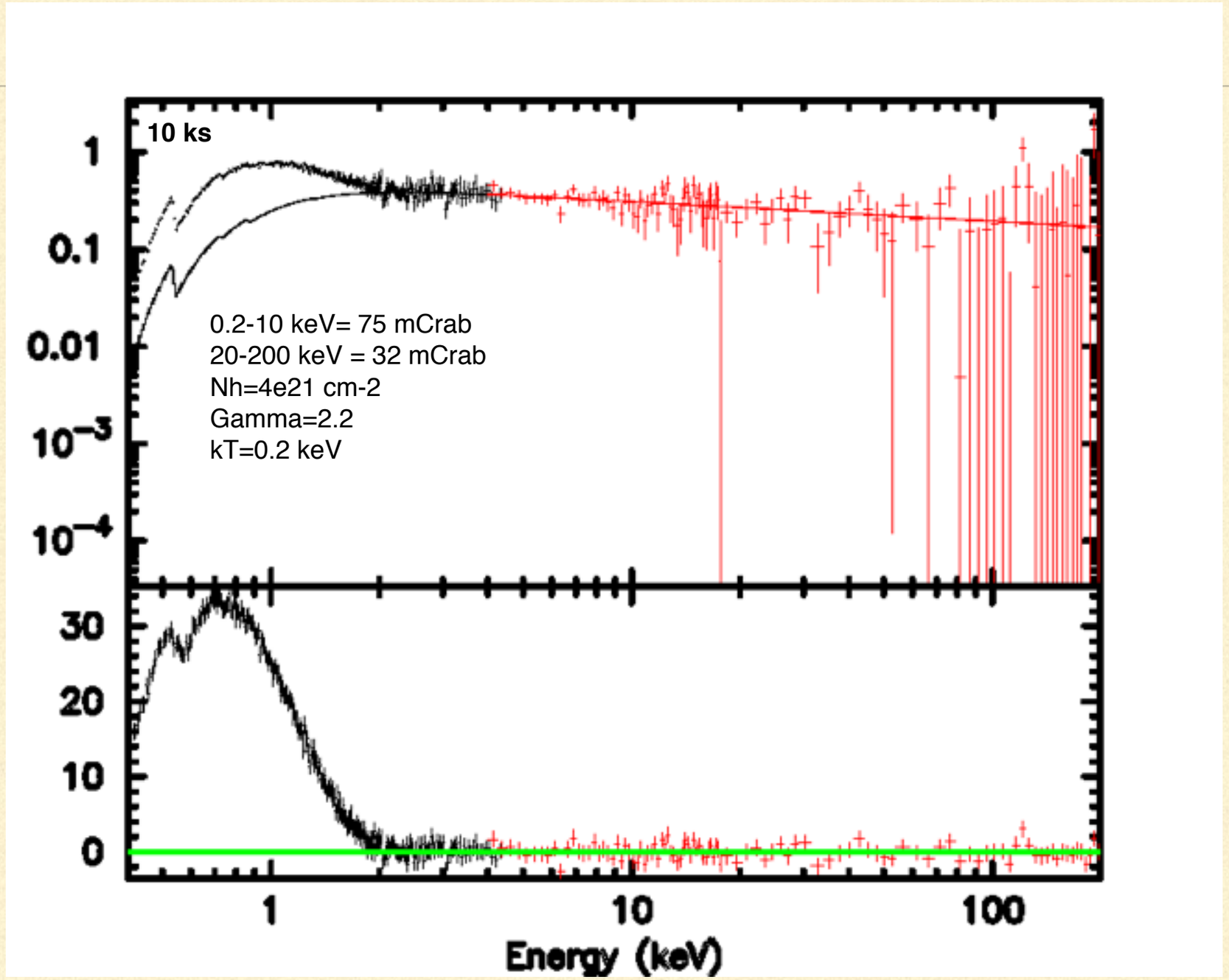


Bright source =>
Possibility to follow on rather short time scale (?)

Detection of specific spectral features



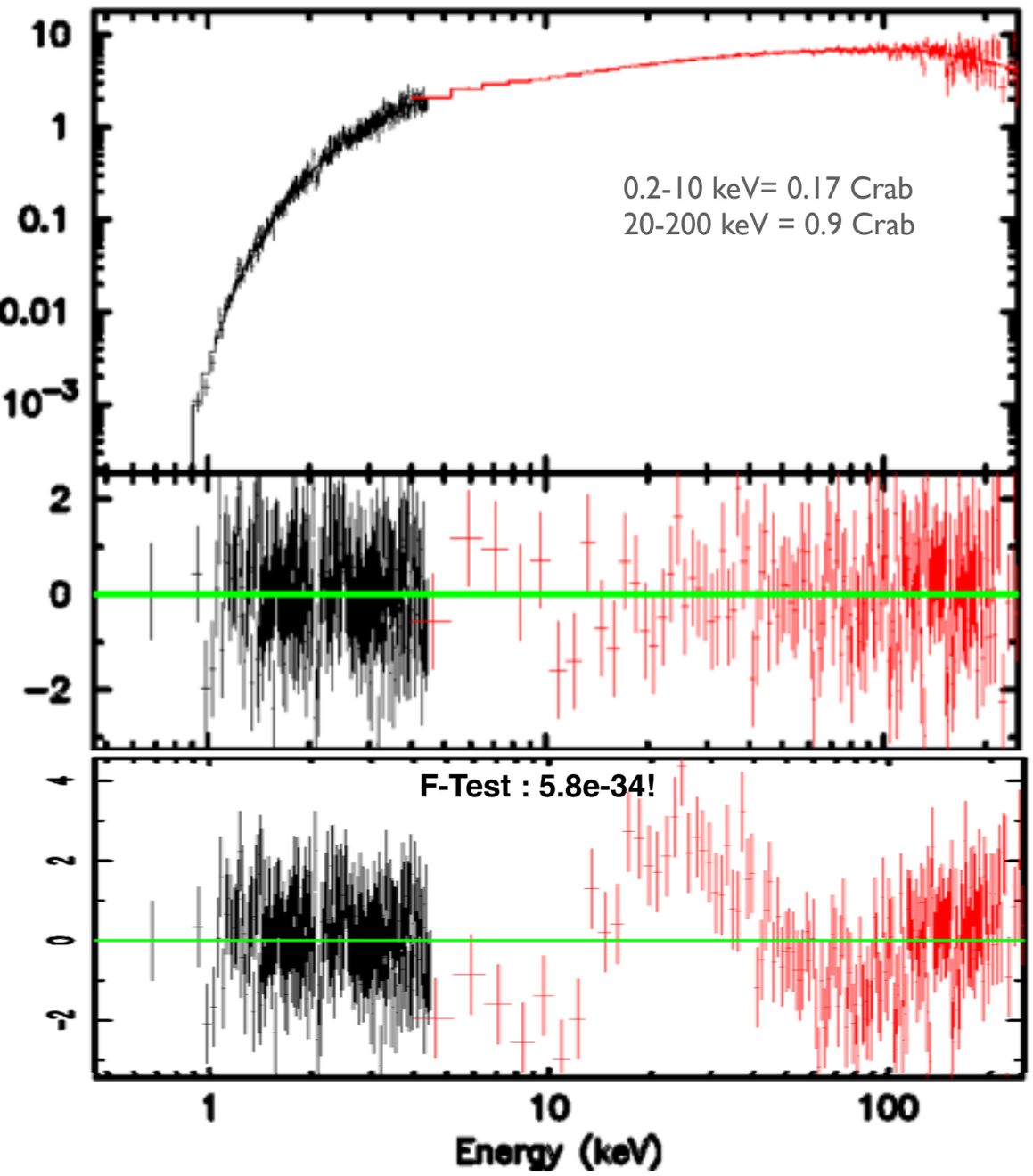
STILL « EASY »: MODERATELY BRIGHT STATES



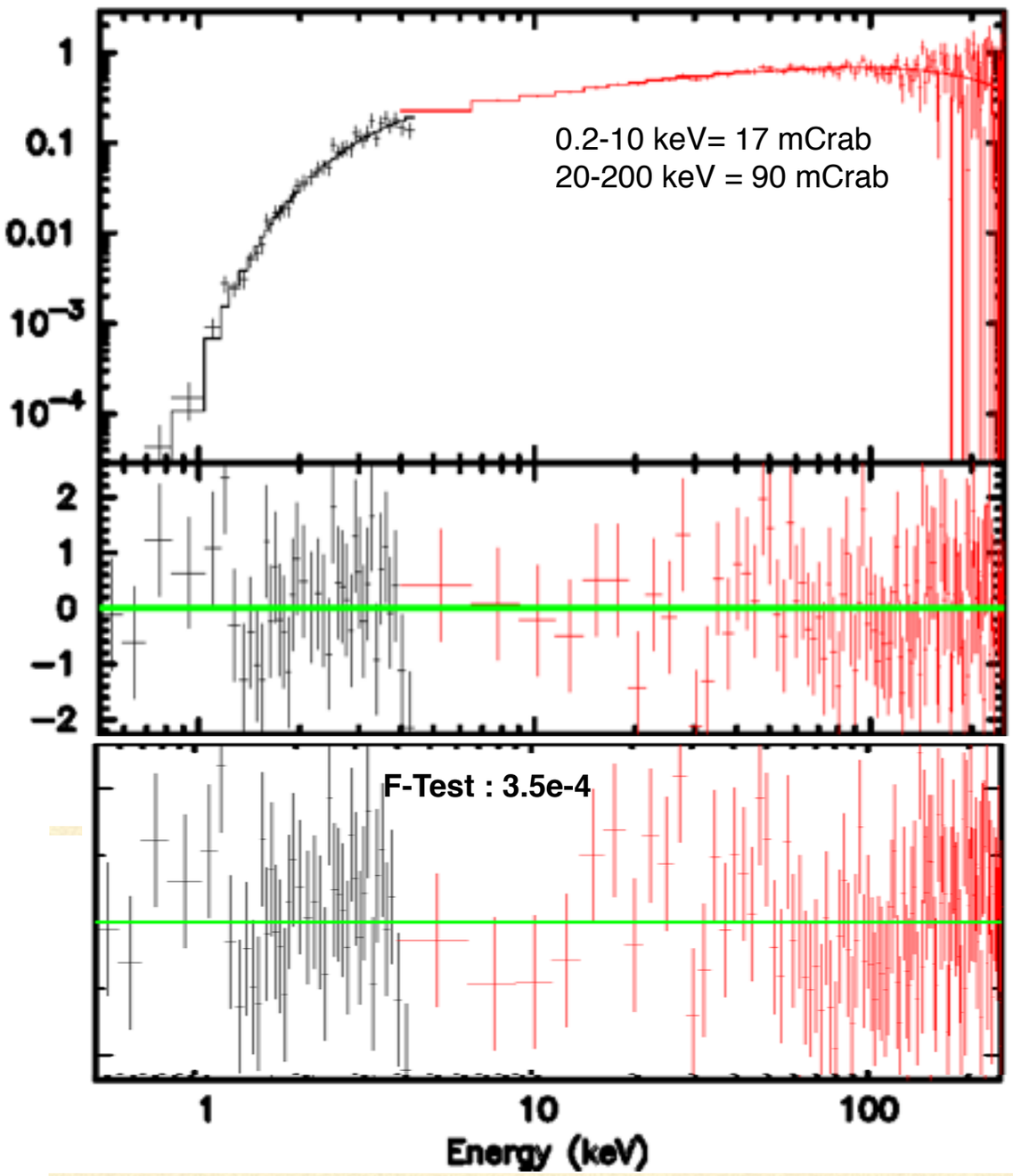
Appearance of disk during spectral transitions

SPECIFIC SPECTRAL COMPONENTS

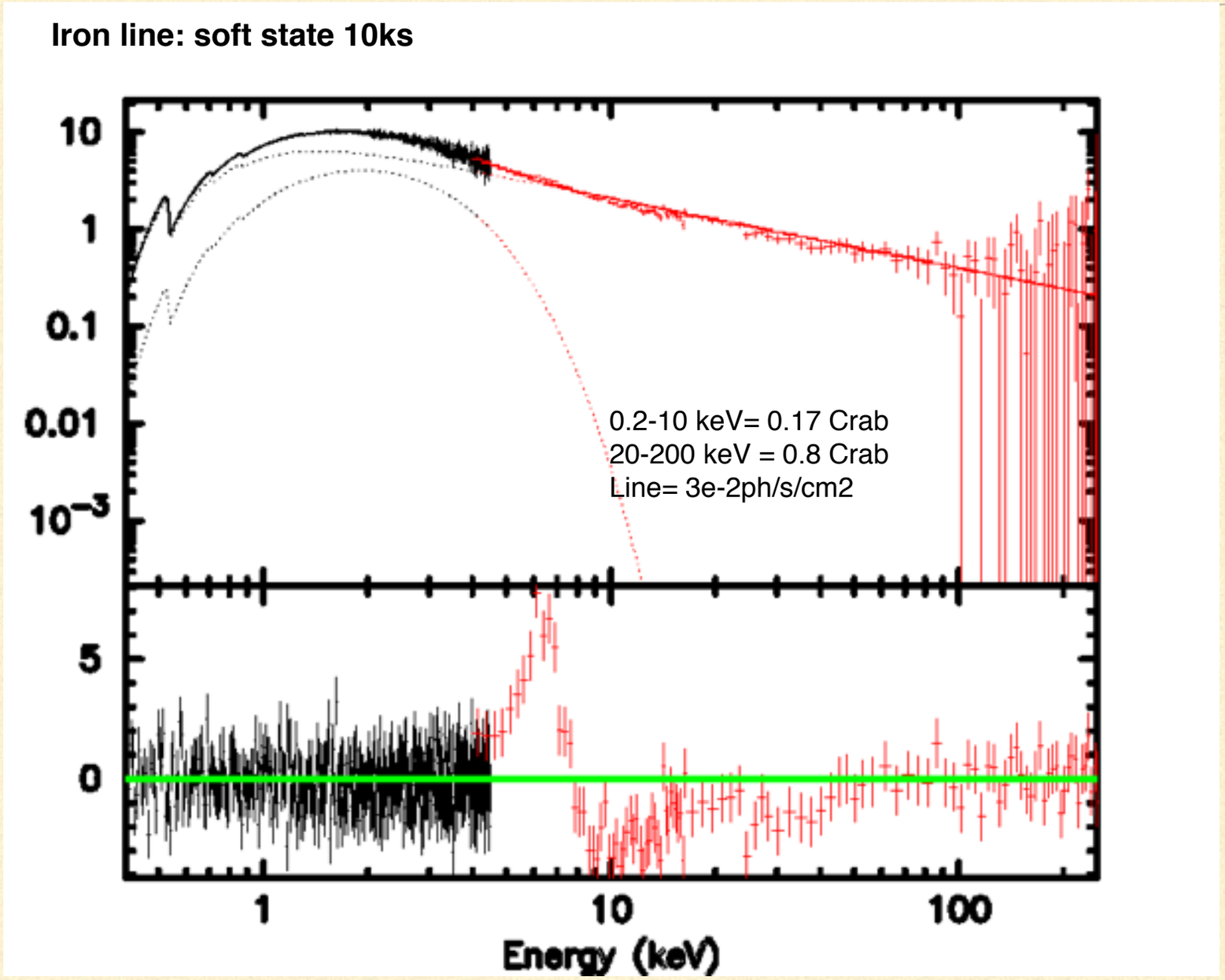
Reflection component: hard state 10ks



Reflection component: hard state 100ks (Eclair)



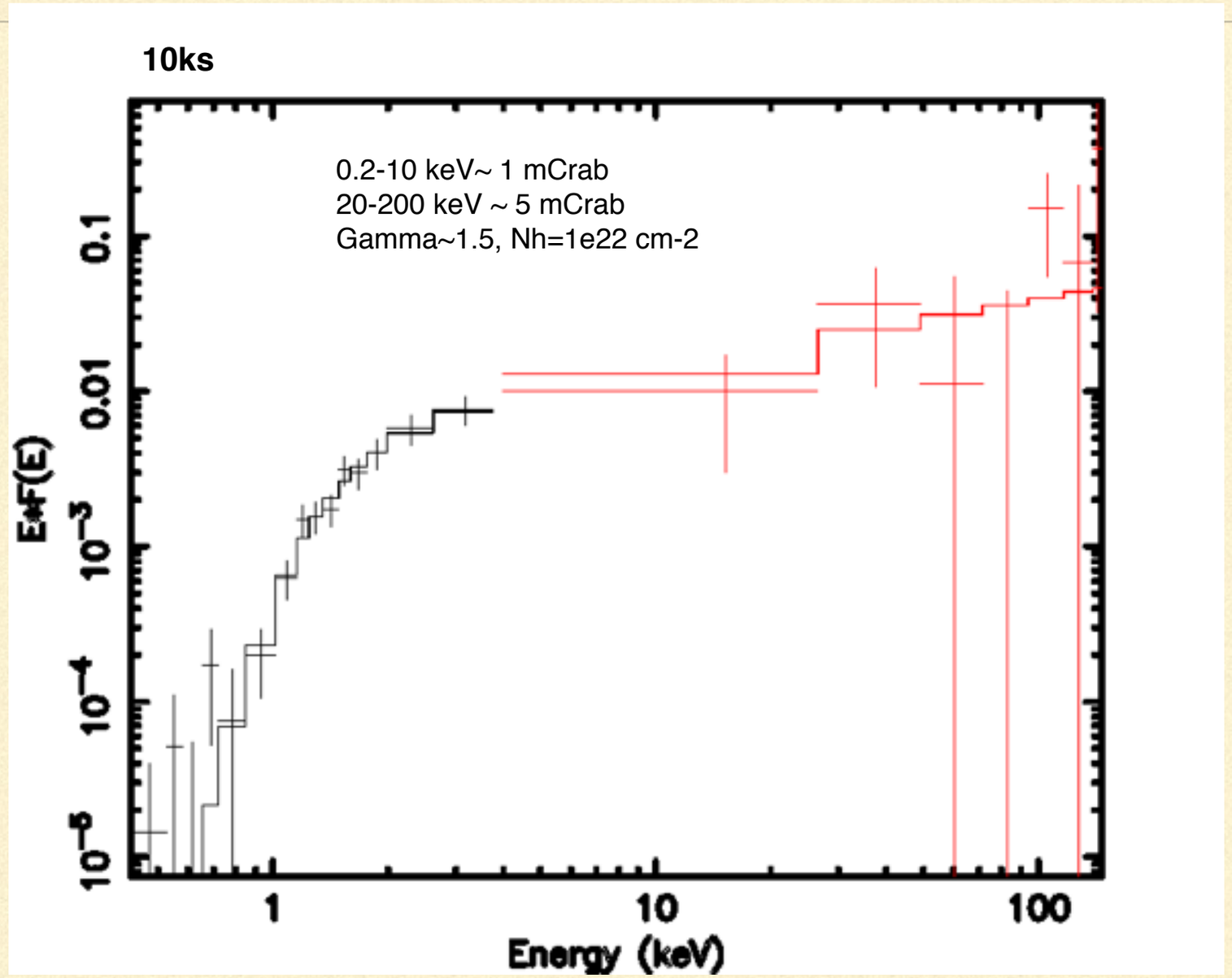
SPECIFIC SPECTRAL COMPONENTS



Clear detection of iron line

=> Simple (broad) gaussian fits the data well

LOW FLUX

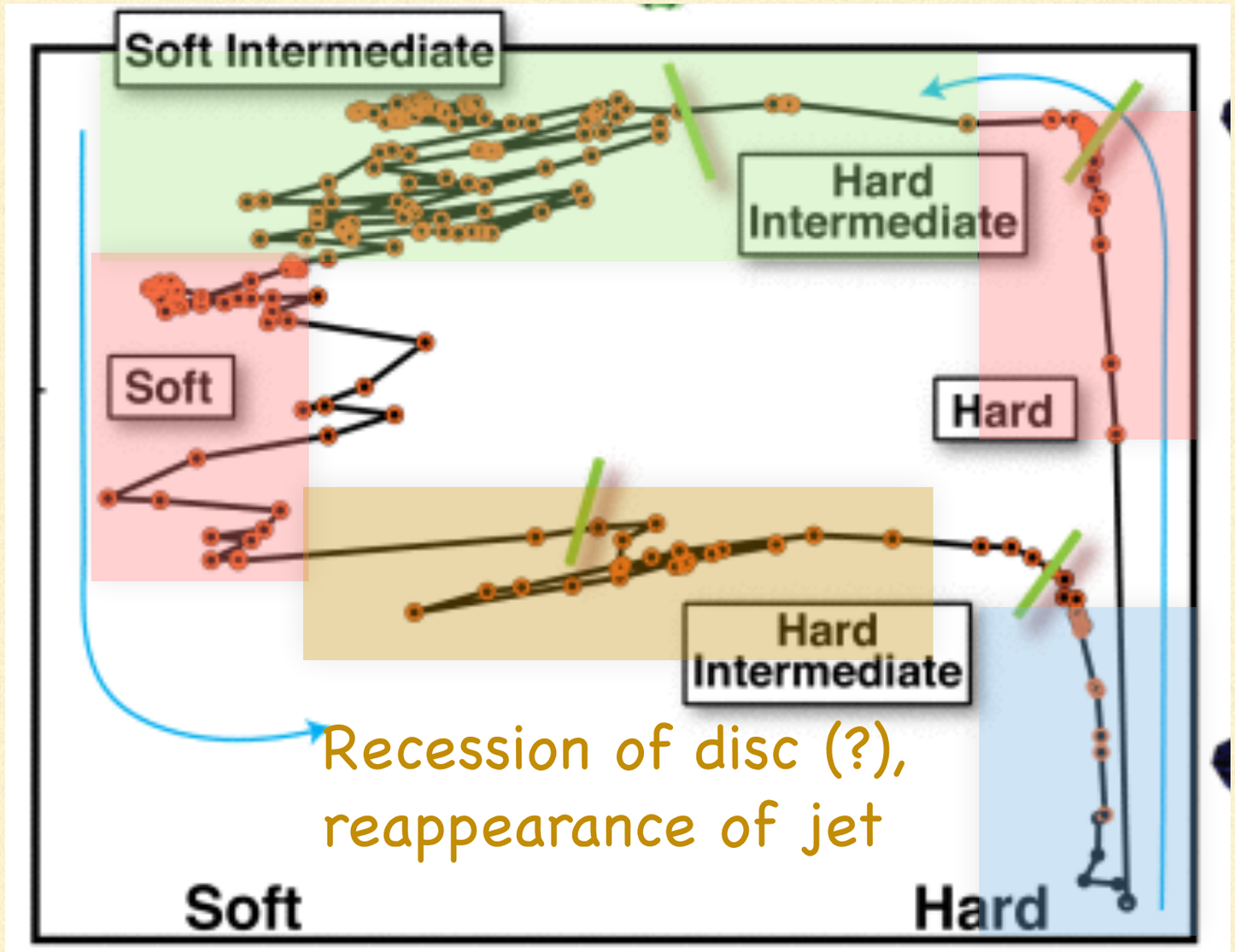


Early stages => basic parameters: Nh & Gamma (E-cut not detected)

SUMMARY OF ACCRETION PHYSICS

Fine spectral analysis: line/reflection/ link with jet-external disk

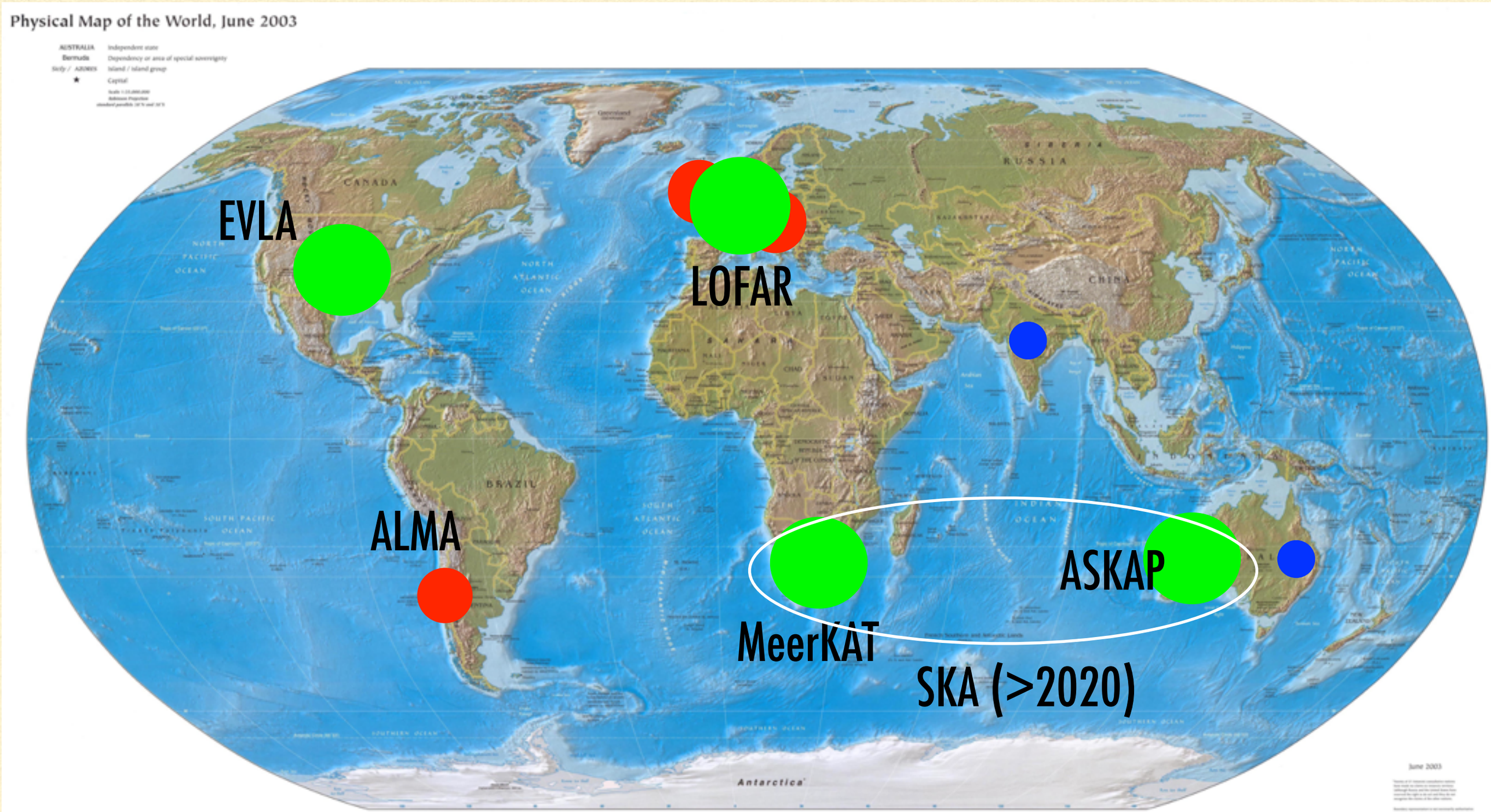
Disk @ LSO: line, inner radius => spin of BH?



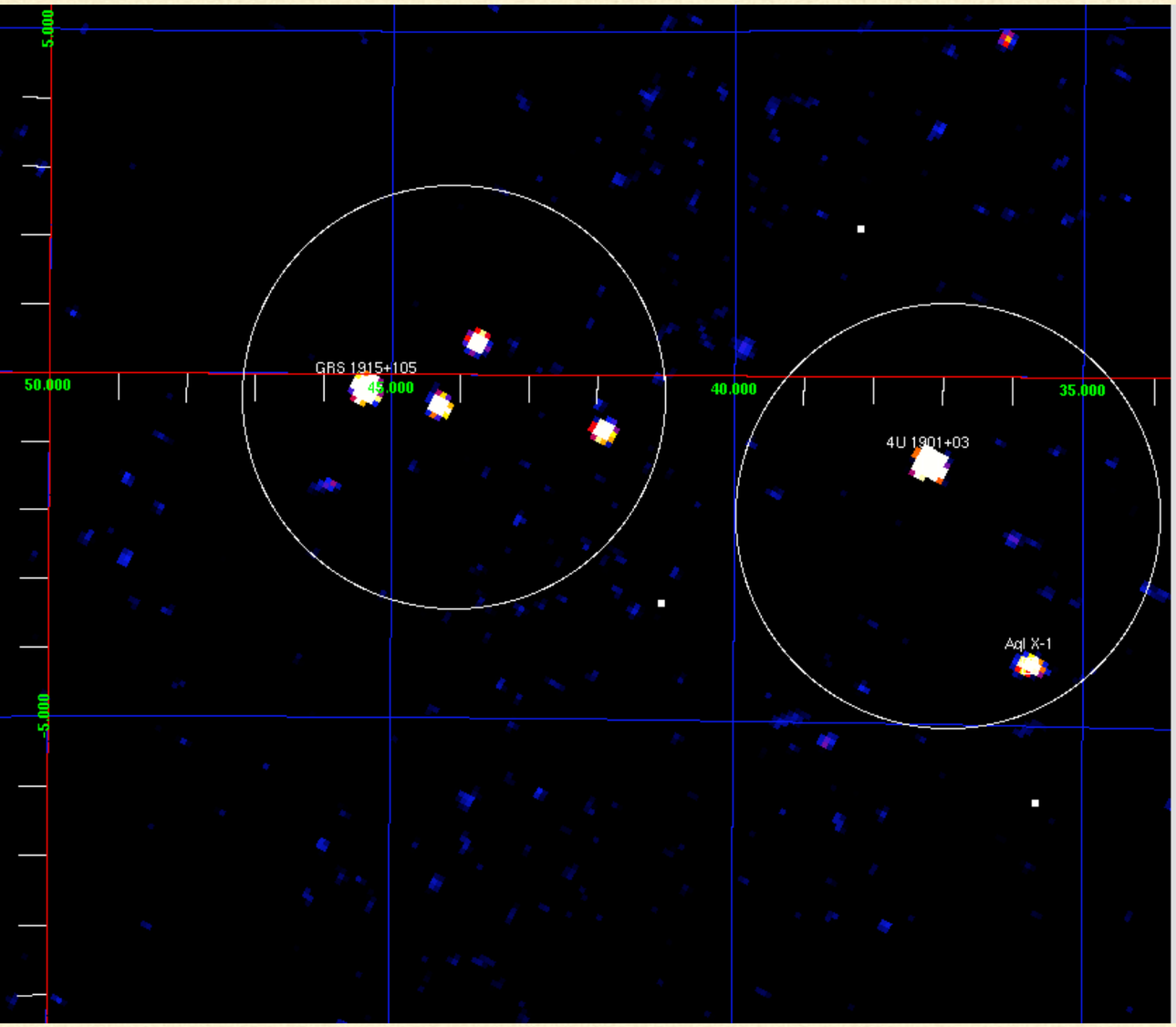
Approach of disk / reflection + multi wavelength

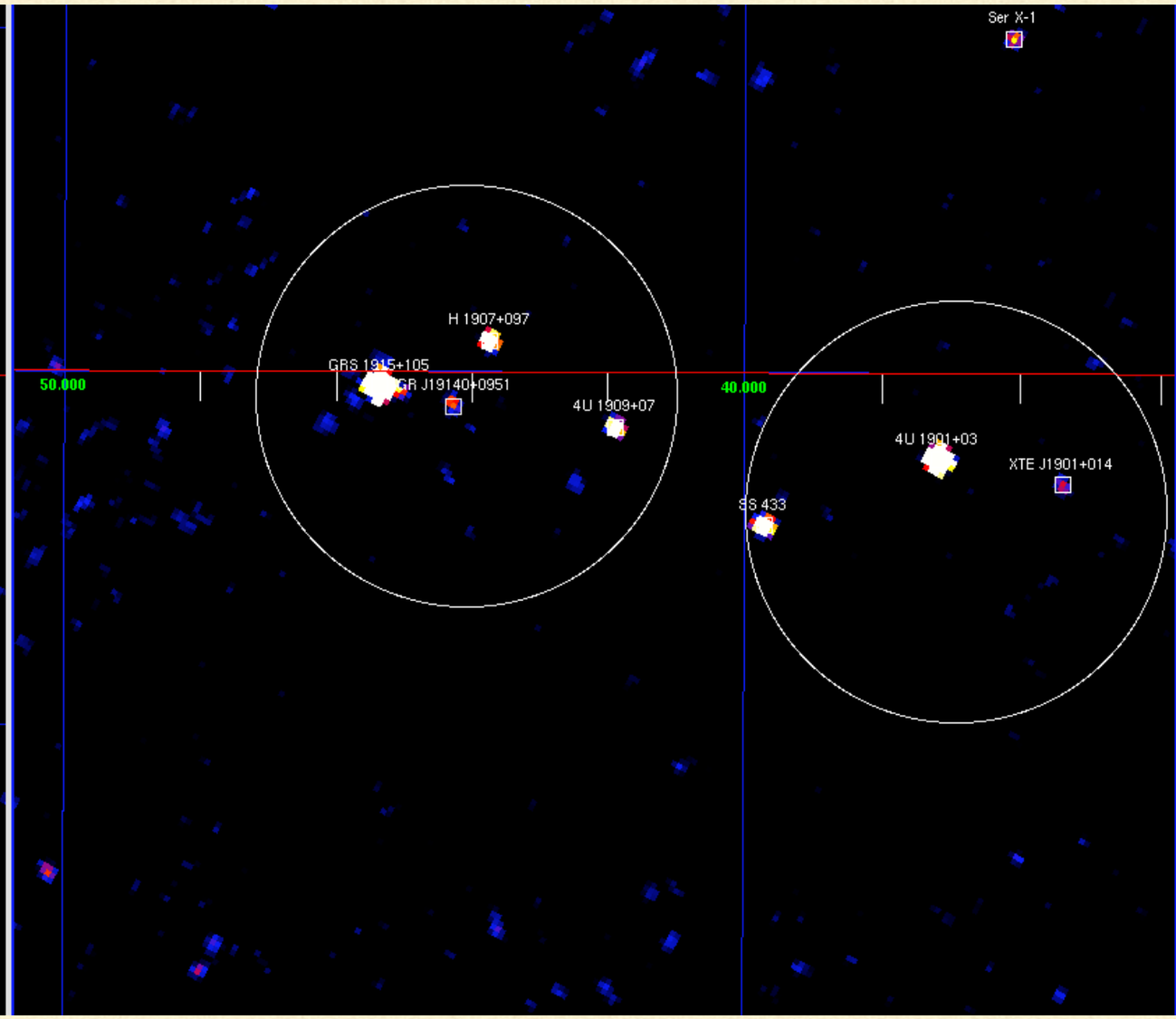
Basic detection

SYNERGIES WITH RADIO …..

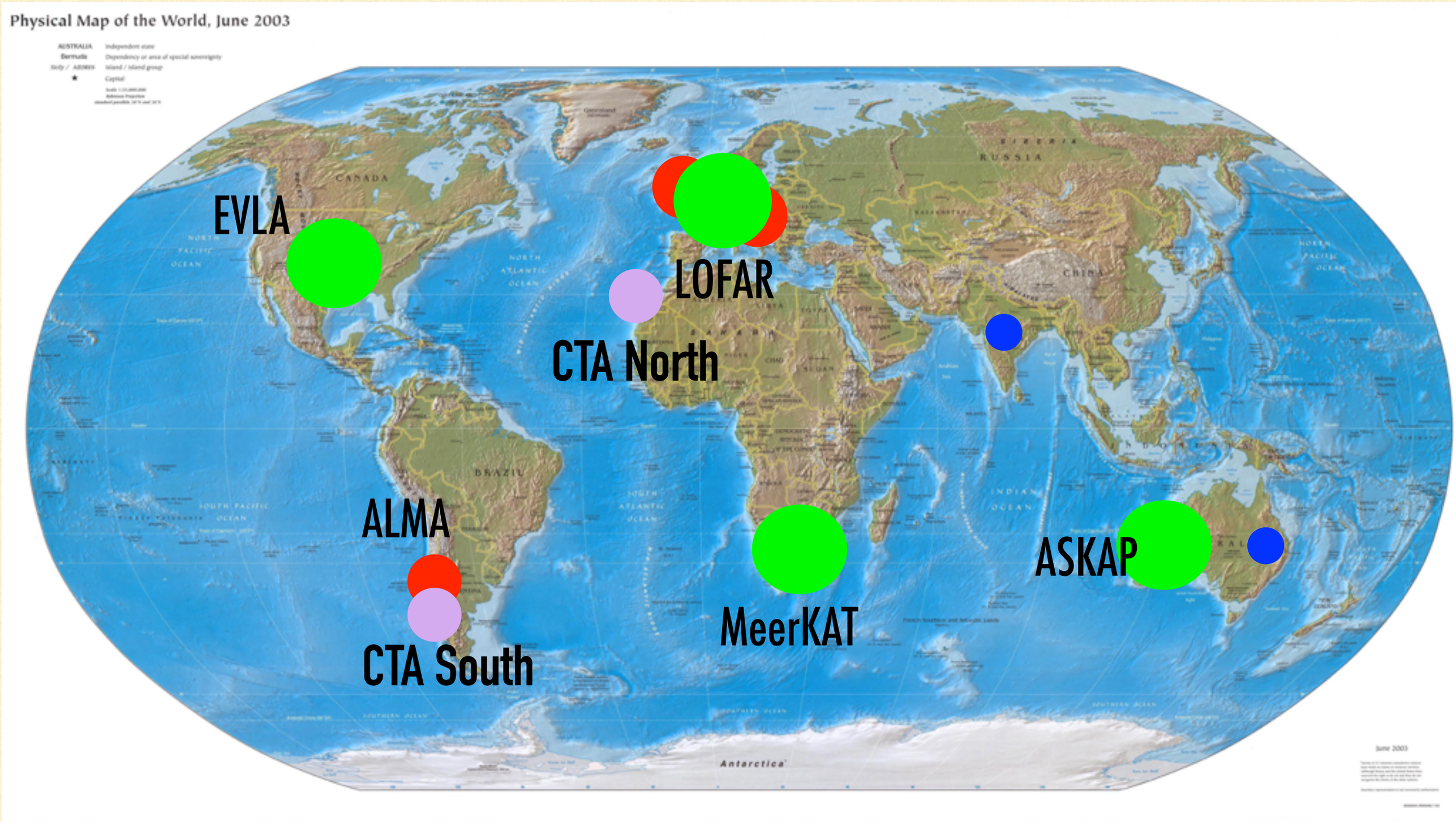


ASKAP/MEERKAT FOV





. . . AND VHE


Physical Map of the World, June 2003
EVLA
LOFAR
CTA North
ALMA
CTA South
MeerKAT
ASKAP
CANADA
RUSSIA
CHINA
BRAZIL
Antarctica
June 2003