Type-I burst as a probe to XRB accretion in the hard state

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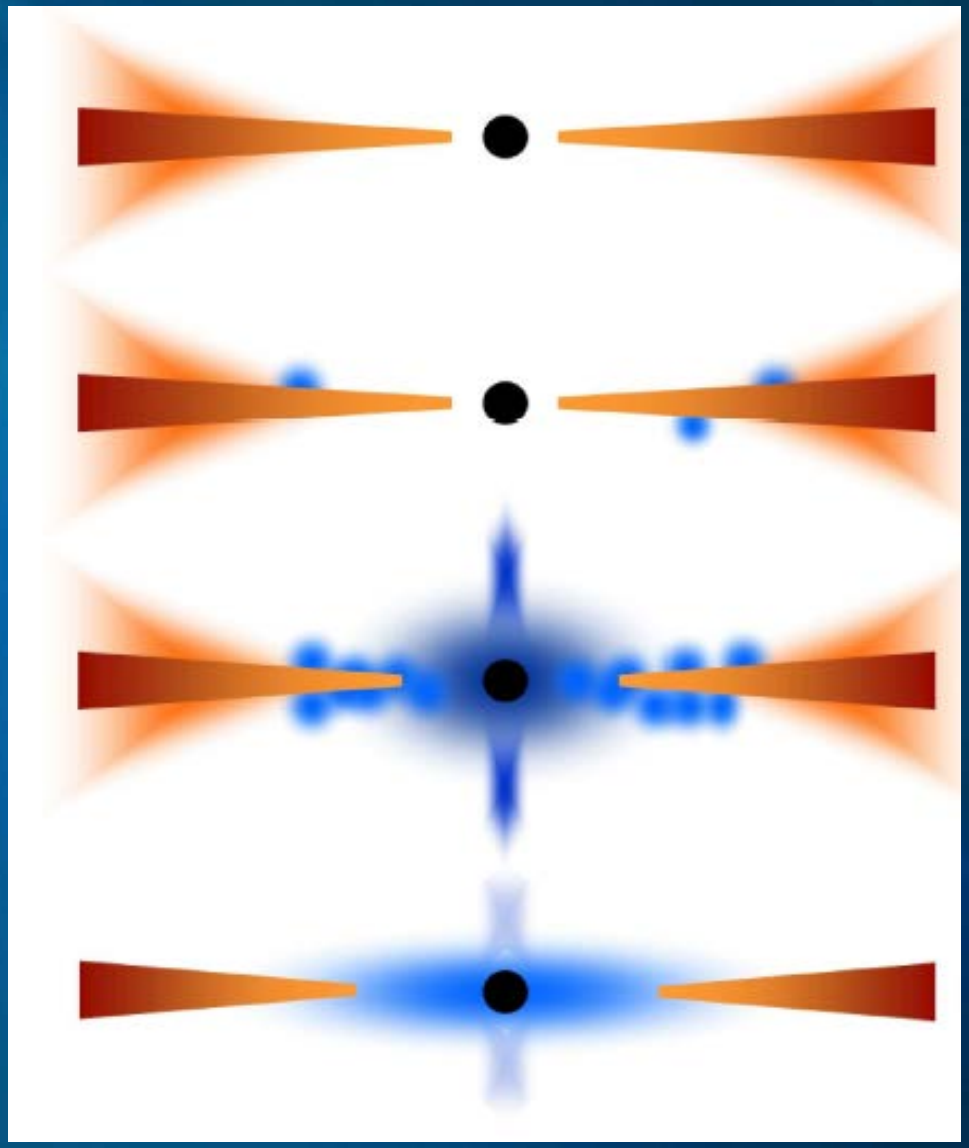
Spectral states



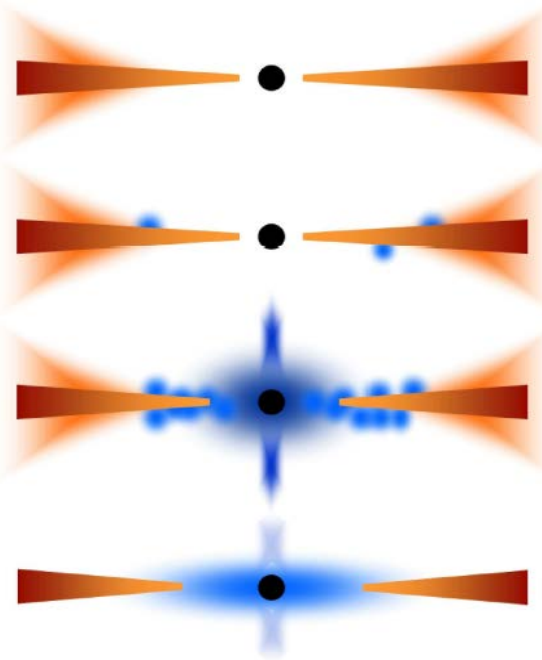
accretion rate

high/ soft state

low/ hard state

(Chris Done et al, 2007)

Spectral states



Observations: the feedback of bursts on the accretion process

- Worpel et al. (2013) proposed that the persistent flux might be increased during bursts.
- Use the model: $B + fa \times P$

  B: black body;

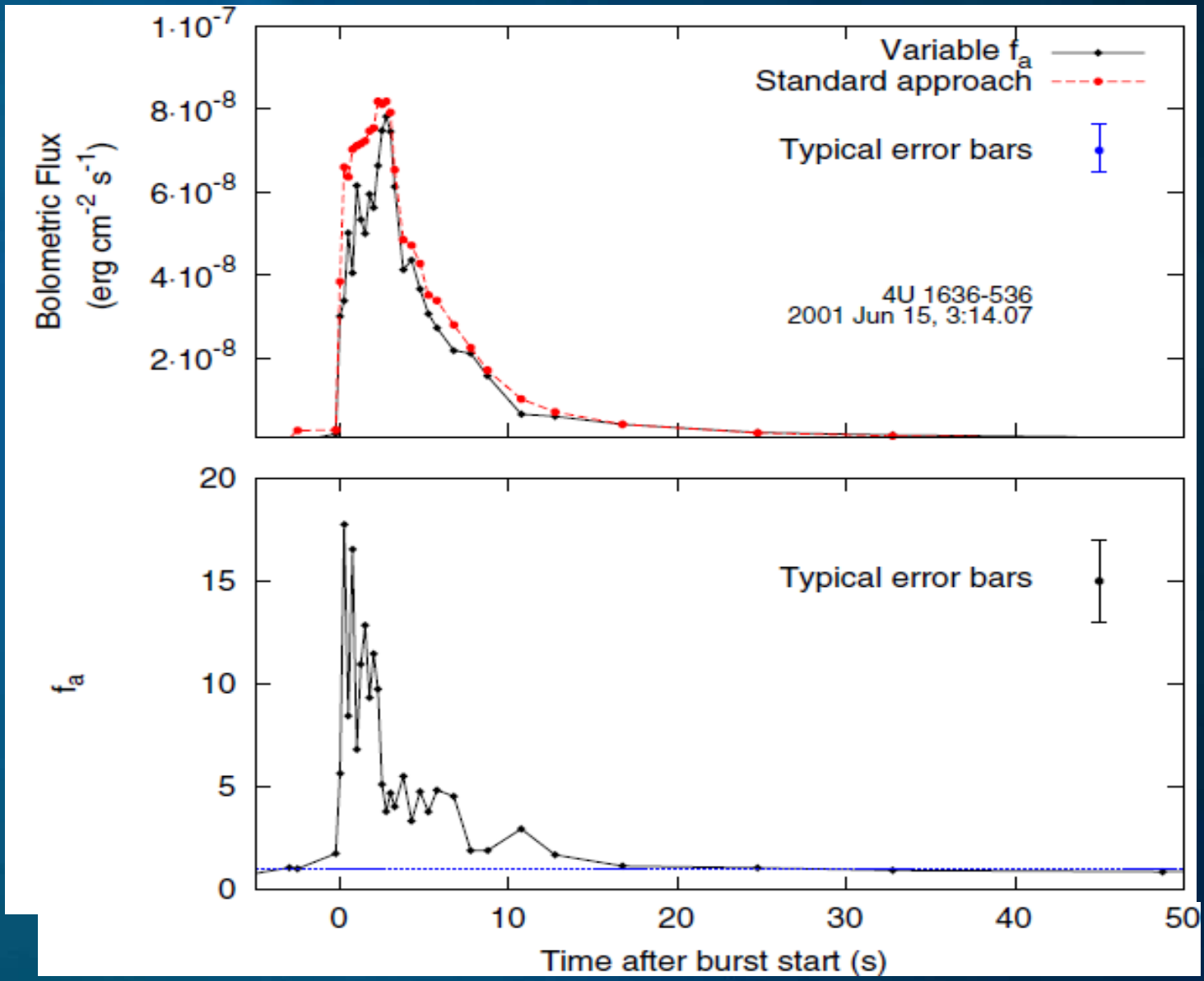
  the model for bursts

  P: persistent emission model;

  freeze parameters at values before bursts

  fa: a multiplicative factor;

Observations: the feedback of bursts on the accretion process



Observations: the feedback of bursts on the accretion process

Question:

If the nature of the persistent emissions in the hard and soft state is different,

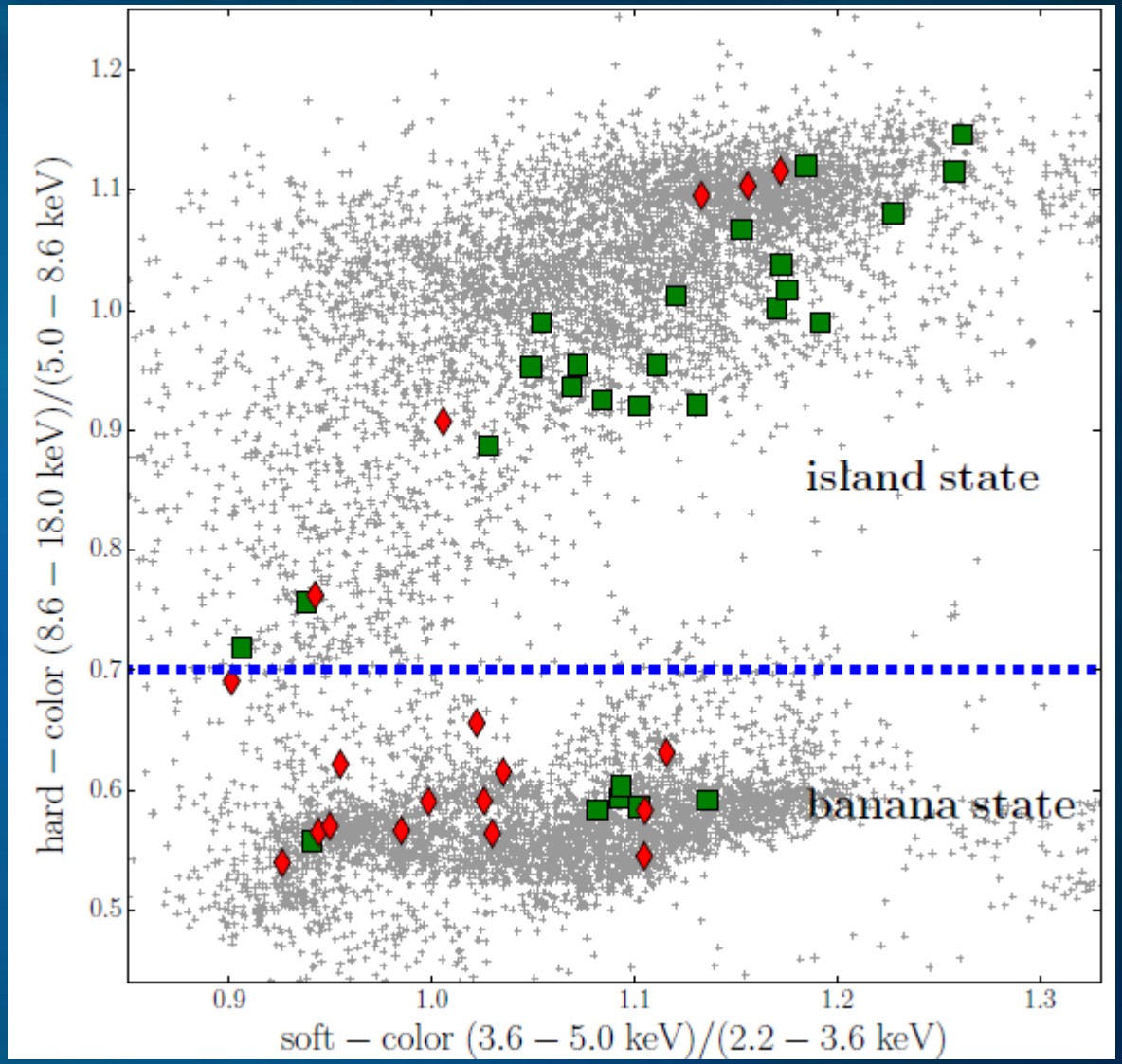
do they have the similar behaviors during bursts?

Observations: the feedback of bursts on the accretion process

PRE

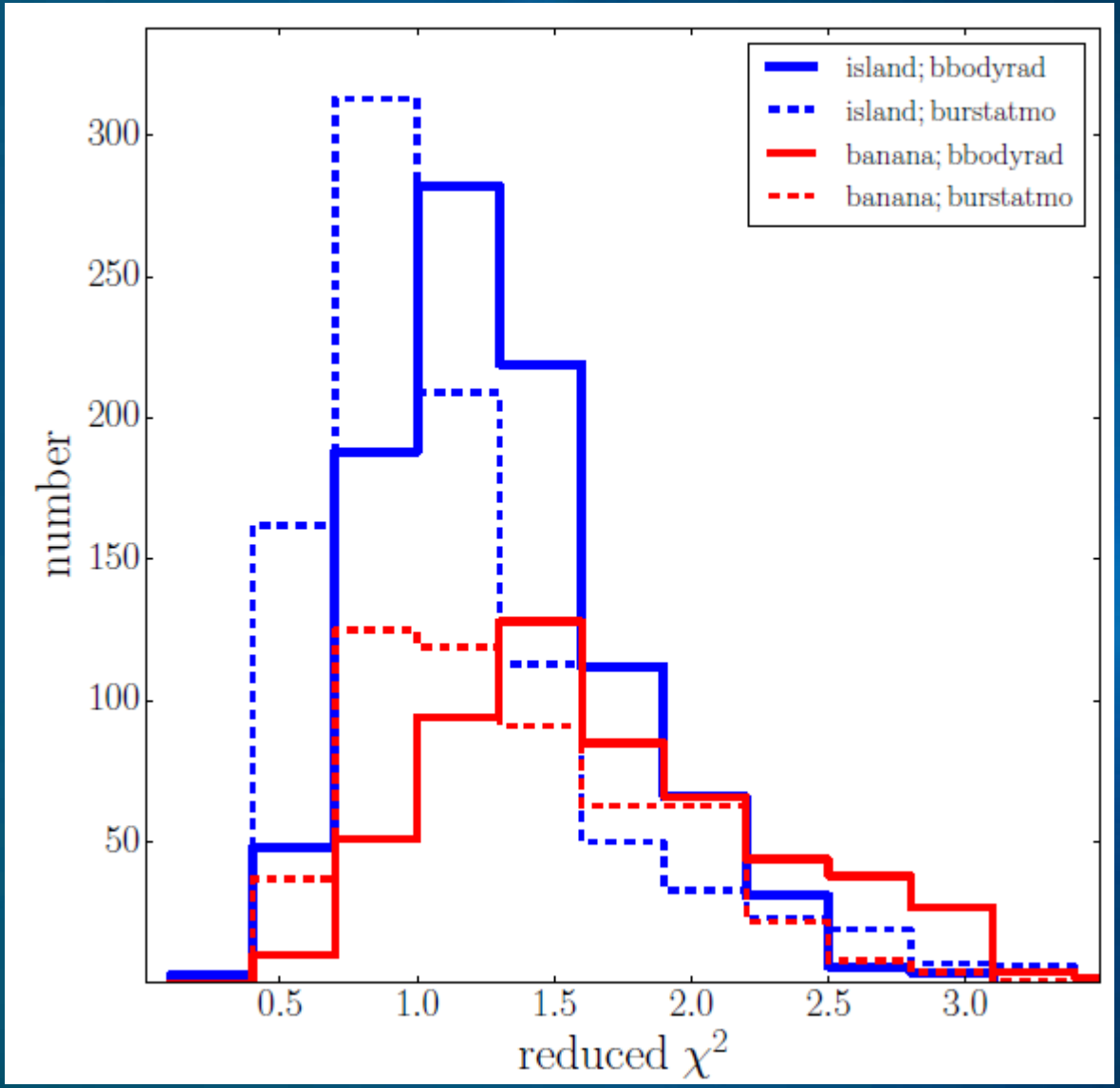
non-PRE

4U 1608-522



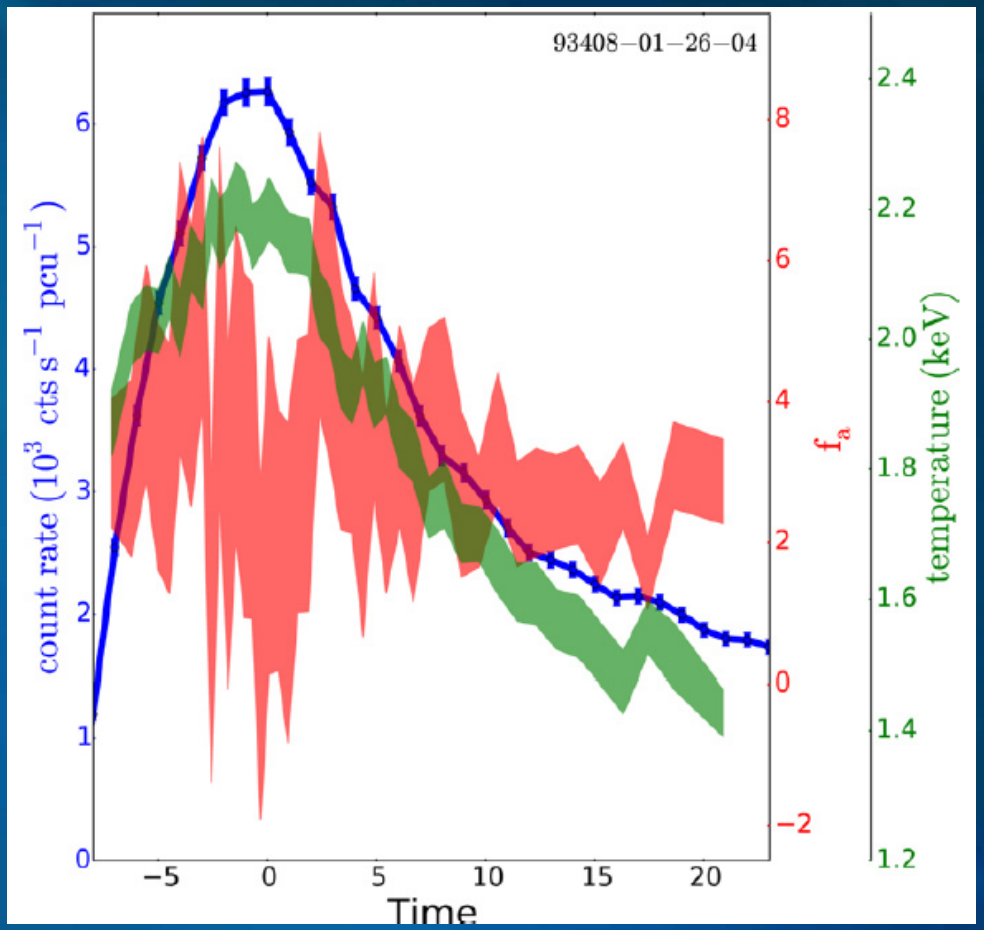
Step1: Classify the bursts based on the CCD

Observations: the feedback of bursts on the accretion process



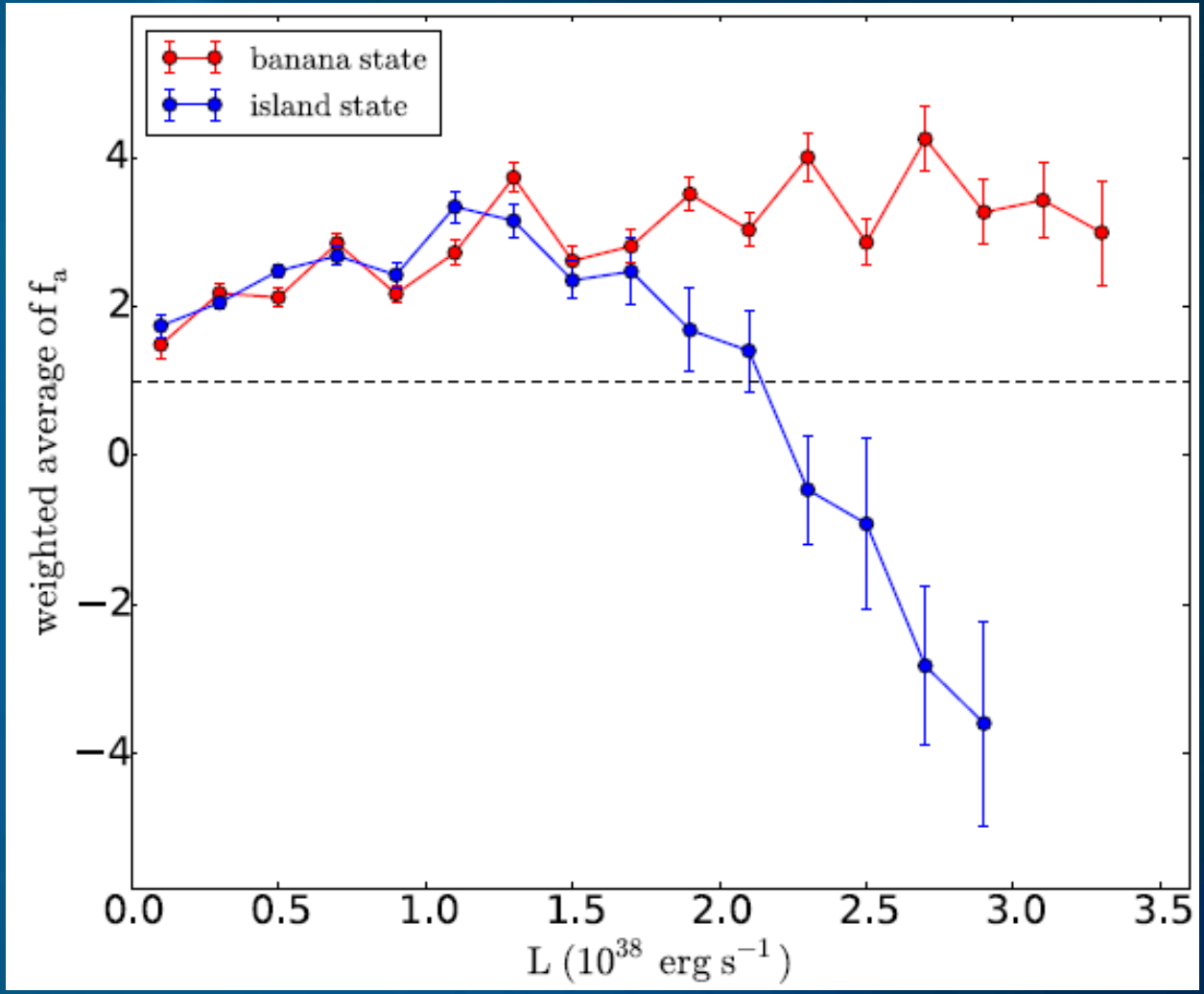
Step 2: : time-resolved spectral analysis assuming a constant persistent flux
fitting spectra with BB model
→→→
Very different goodness-of-fits

Observations: the feedback of bursts on the accretion process



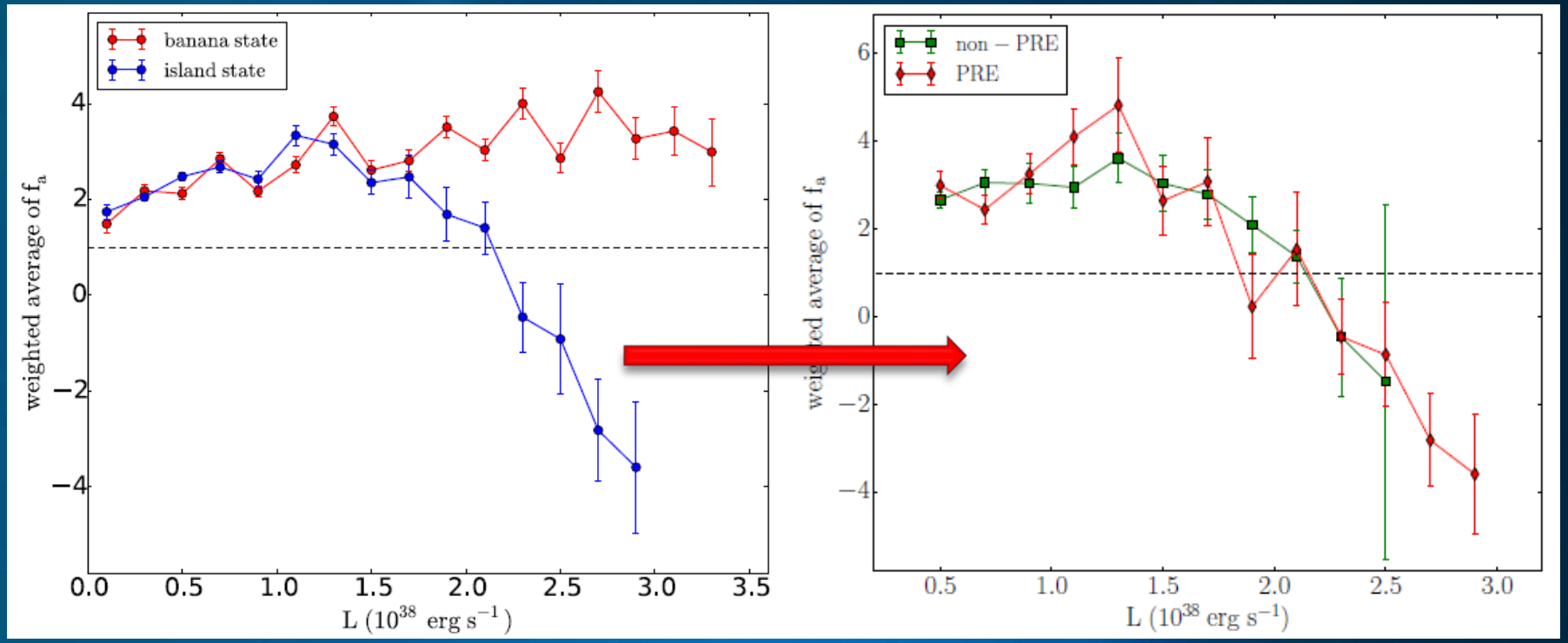
Step 3: time-resolved spectral analysis including variable persistent flux.

Observations: the feedback of bursts on the accretion process



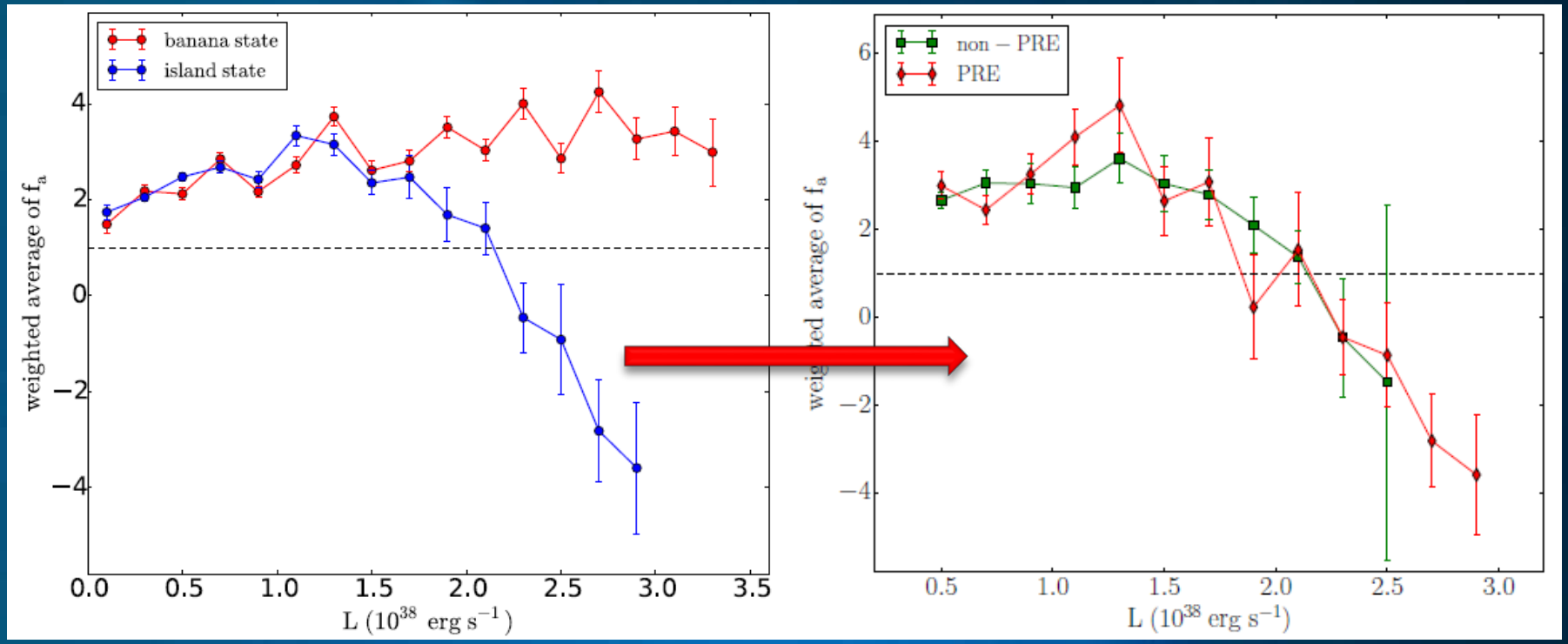
Why do different states have different fa trends ?

Observations: the feedback of bursts on the accretion process



Why do different states have different fa trends ?

Observations: the feedback of bursts on the accretion process

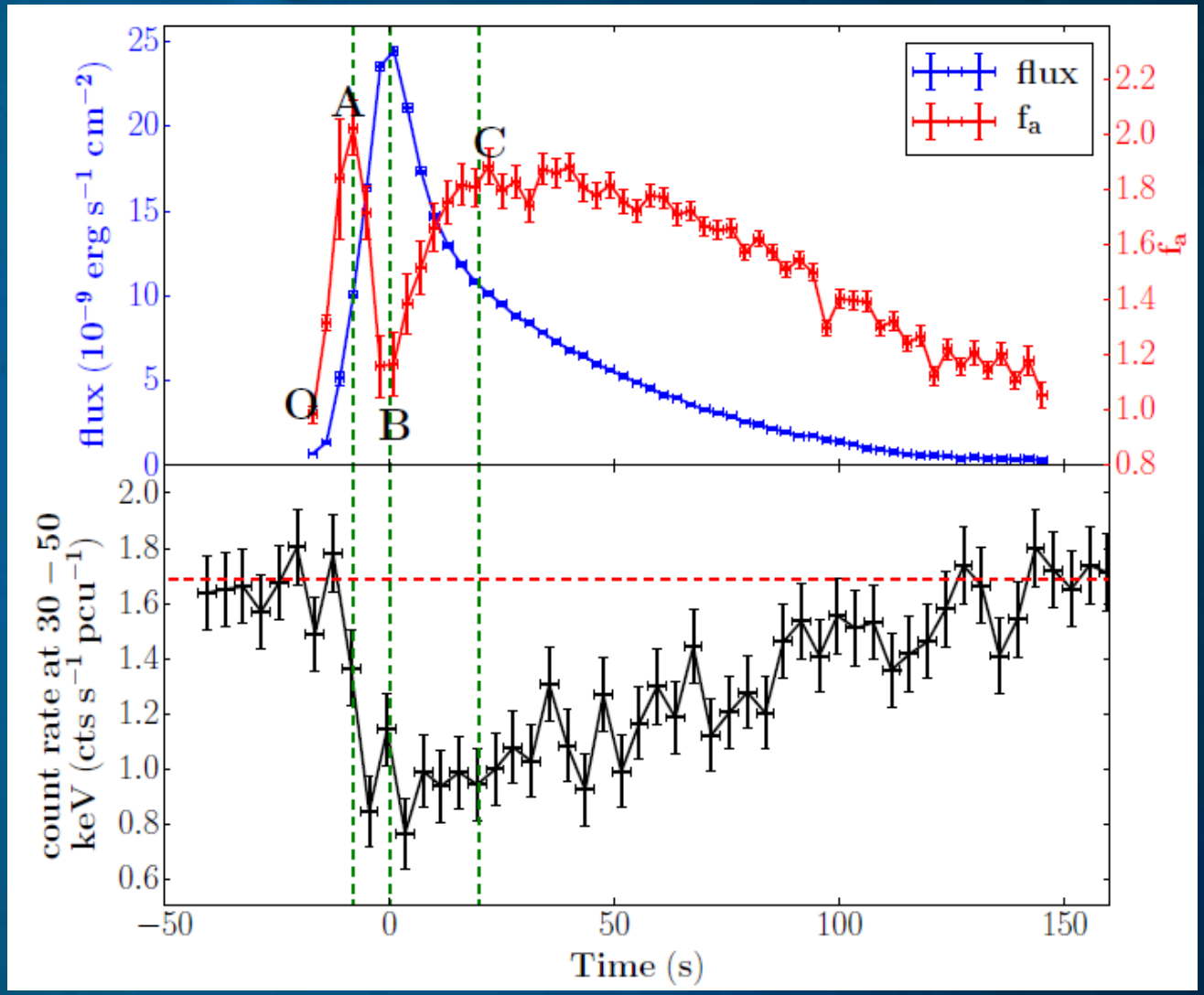


Why do different states have different fa trends ?
interact with:

the disk in the soft state;

the corona in the hard state??

Another source: GS 1826-238; an atoll source; always in the hard state; significant hard X-ray shortage

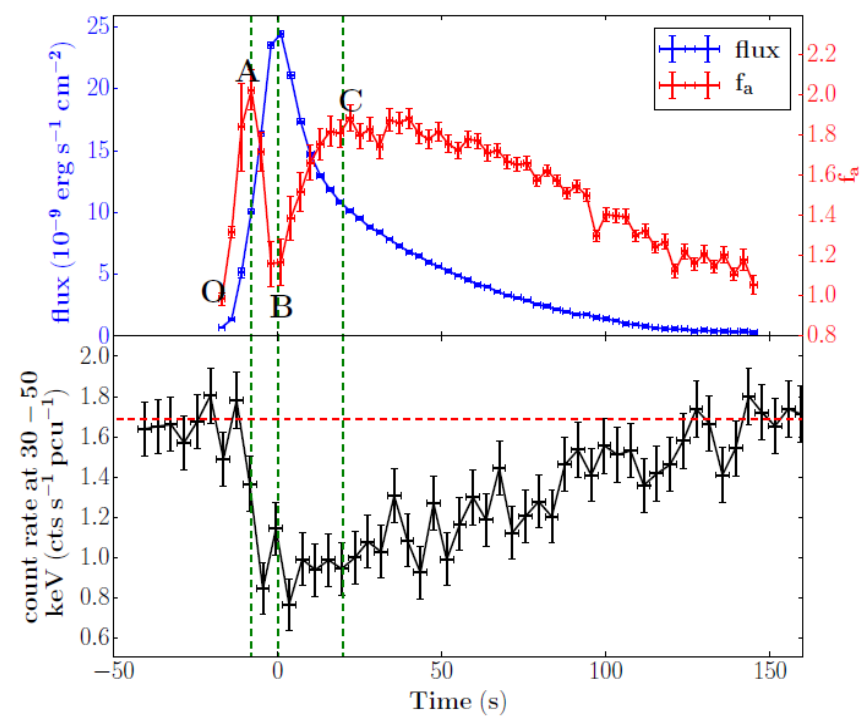


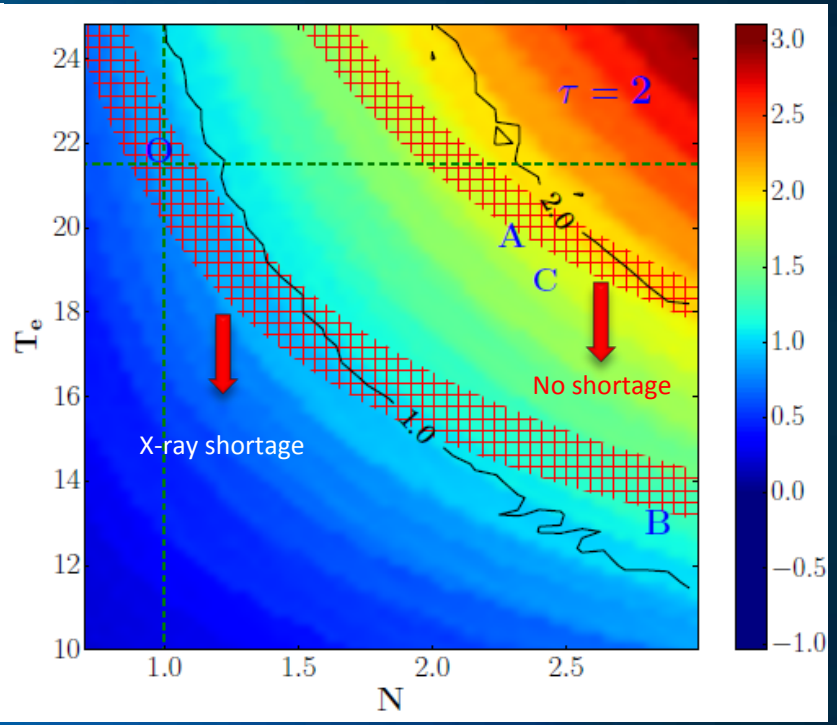
Simultaneous **enhanced** soft X-rays and **diminished** hard X-rays

the possible physical processes in theory

- the corona cooling

seed photons, electron temperature, optical depth





the increased seed photons

---> increased fa ✓

the decreased coronal temperature

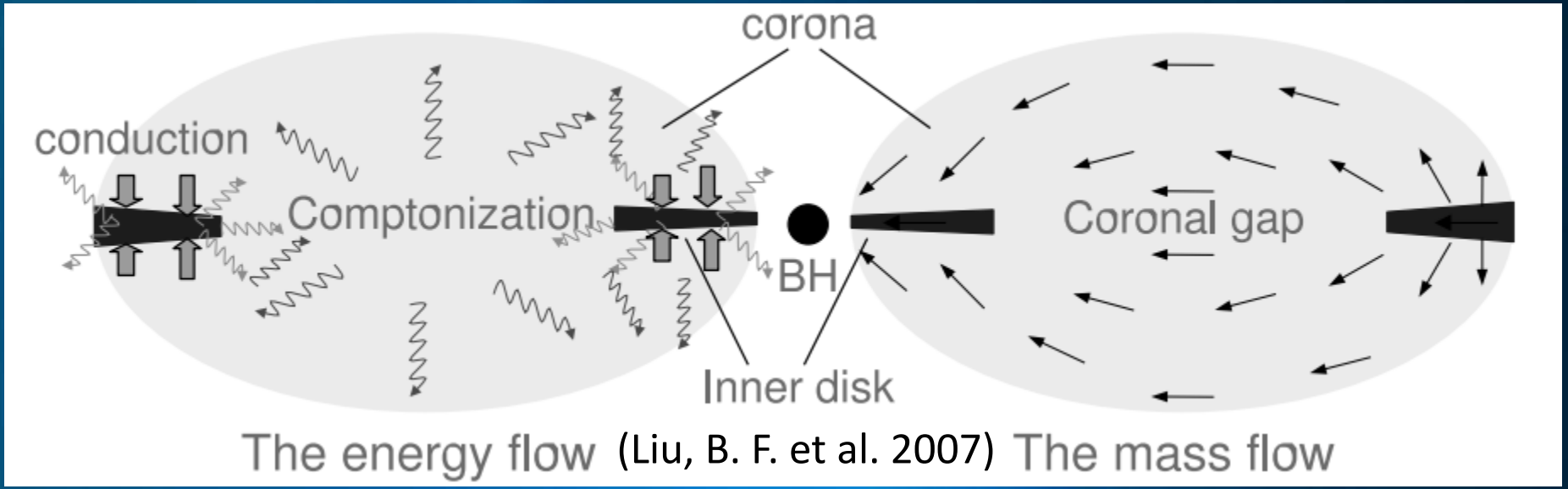
---> hard X-ray shortages ✓

Other possible physical processes

- change the disk structure
- Inflow caused by Poynting-Robertson drag
- others

the possible physical processes in theory

- Changes of the disk structure



The condensation of matter from a corona to a cool, optically thick inner disk under the strong Compton cooling.

an enhanced inner disk

---> increased fa ✓

a weaker corona

---> hard X-ray shortages ✓

the possible physical processes in theory

- Inflow caused by Poynting-Robertson drag

  remove the angular momentum efficiently

  --->increased accretion

  ---> increased fa

  hard to explain the diminished hard X-rays

Summary:

- The enhanced soft X-rays:
  - the increased seed photons in Compton scattering
  - an additional inner disk
  - Poynting-Robertson drag
- The diminished hard X-rays:
  - outflow
  - Compton cooling

Thank you!