Time series decomposition using dynamic factor model

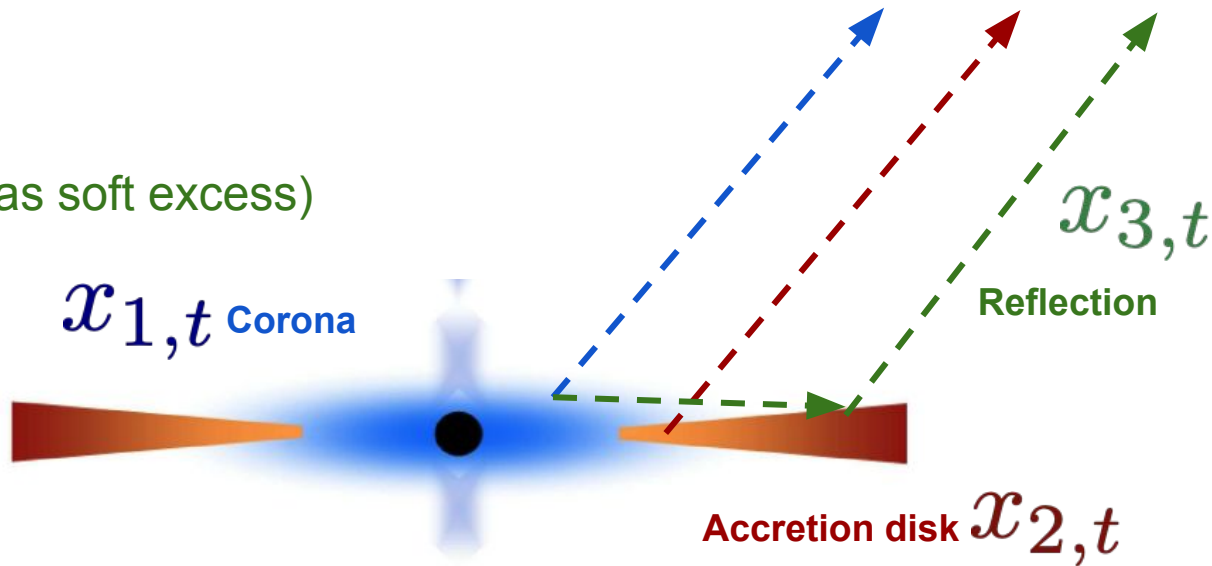## Application to black hole X-ray light curves with NICER

Tomoki Omama
(the Graduate University for Advanced Studies, Japan / ISAS JAXA)
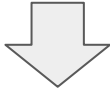
Components of Black Hole Binary

Black Hole Binary (BHB)

- Accretion disk

- Corona

- Reflection (known as soft excess)

$x_{1,t}$ **Corona**

$x_{3,t}$

Reflection

Accretion disk $x_{2,t}$
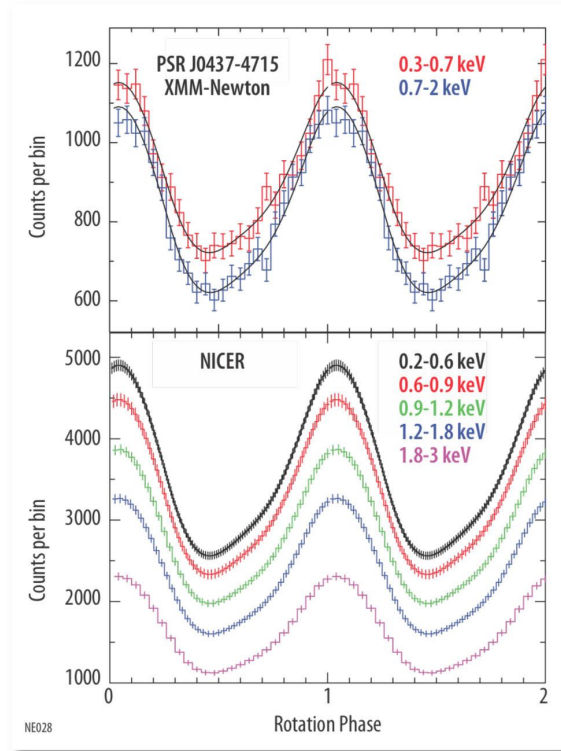
Revised Done et al. 2007

High Statistics Observation with NICER
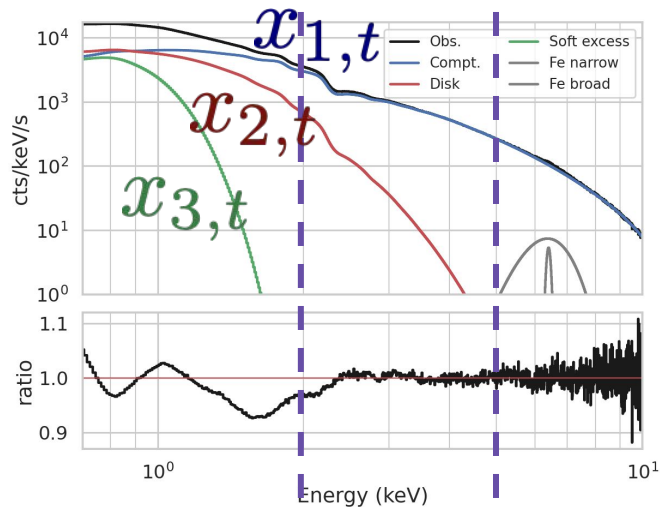
Previous
(XMM)

NICER

NICER

- Installed on the ISS in 2017
- Large effective area + high time resolution

  → observation with high statistics

Multivariate
time series modeling

Energy Spectrum and dynamic factor model

BHB nove MAXI J1820+070

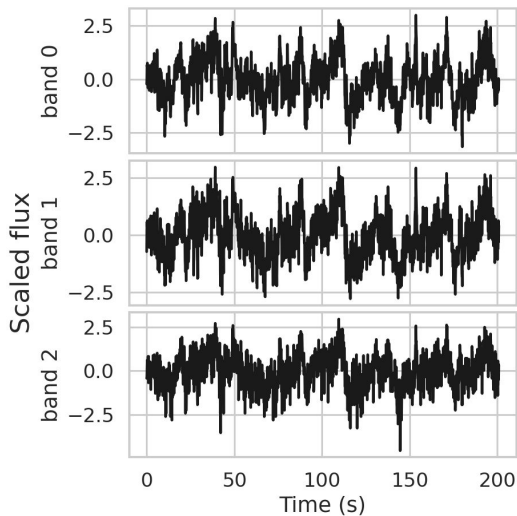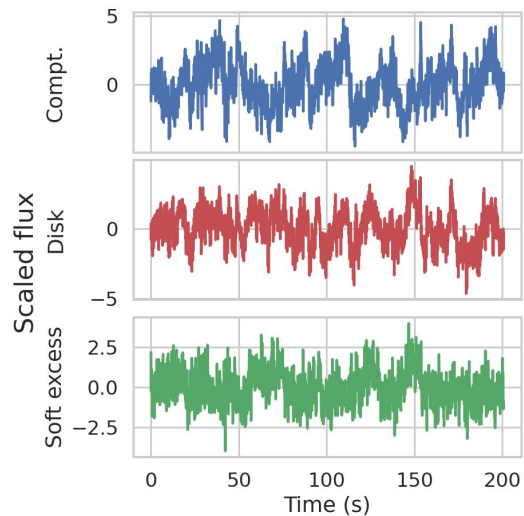$$\boldsymbol{y}_t \qquad \boldsymbol{A} \qquad \boldsymbol{x}_t$$

$$\begin{bmatrix} y_{1,t} \\ y_{2,t} \\ y_{3,t} \end{bmatrix} = \begin{bmatrix} a_{1,1} & a_{1,2} & a_{1,3} \\ a_{2,1} & a_{2,2} & 0 \\ a_{3,1} & 0 & 0 \end{bmatrix} \begin{bmatrix} x_{1,t} \\ x_{2,t} \\ x_{3,t} \end{bmatrix}$$

Dynamic factor model (observation)

→ Infer in the state space model

$$\boldsymbol{y}_t = \left(y_{1,t} \ y_{2,t} \ y_{3,t} \right)^T$$

Decomposed Factor Curves

My poster explains

- detailed model setting

- spectral property