

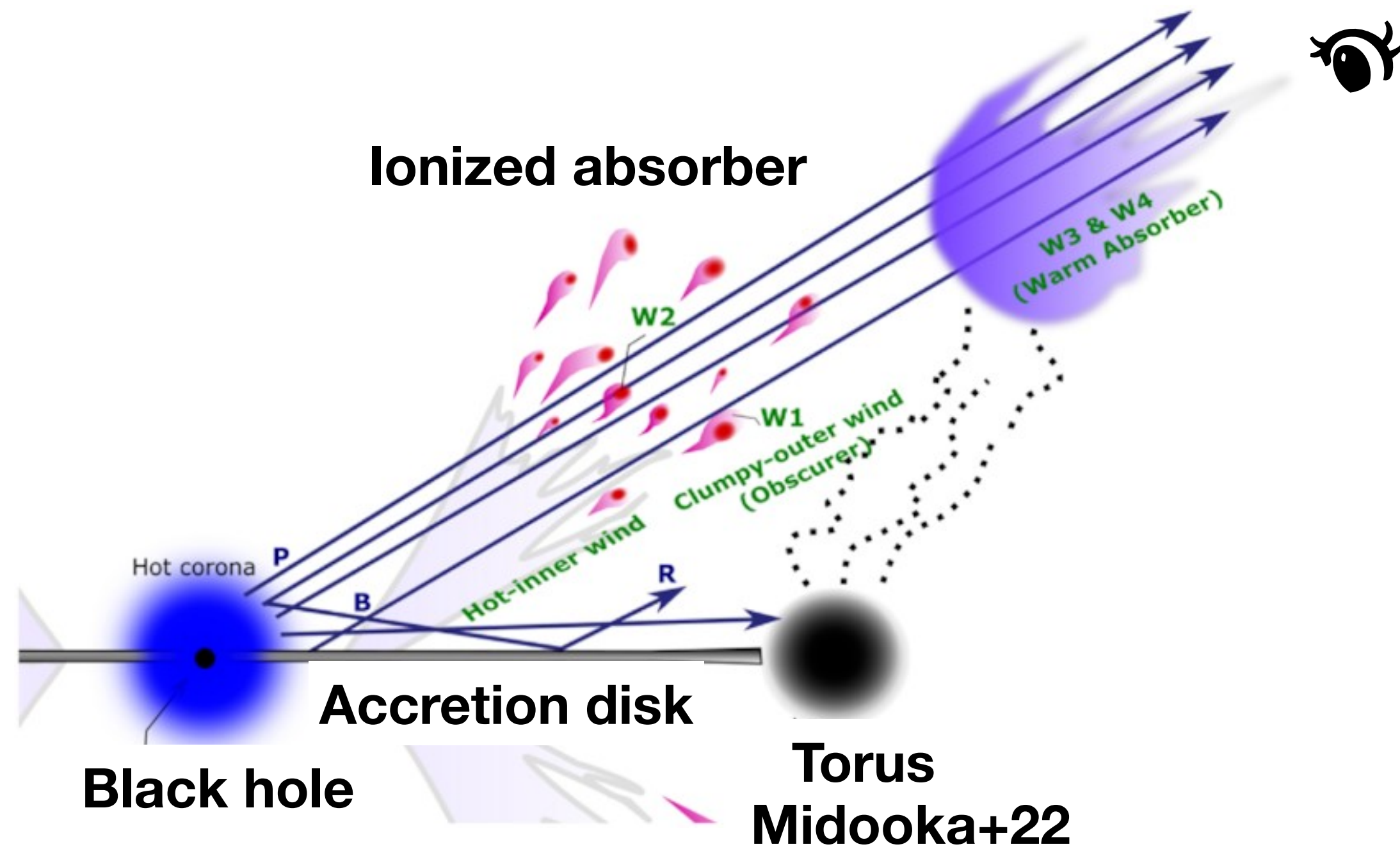
January 19th, 2024

The 2nd XRISM Community Workshop @ UMD

# **XRISM Study on Ionized Absorbers of MCG-06-30-15**

**Shoji Ogawa (ISAS/JAXA)**

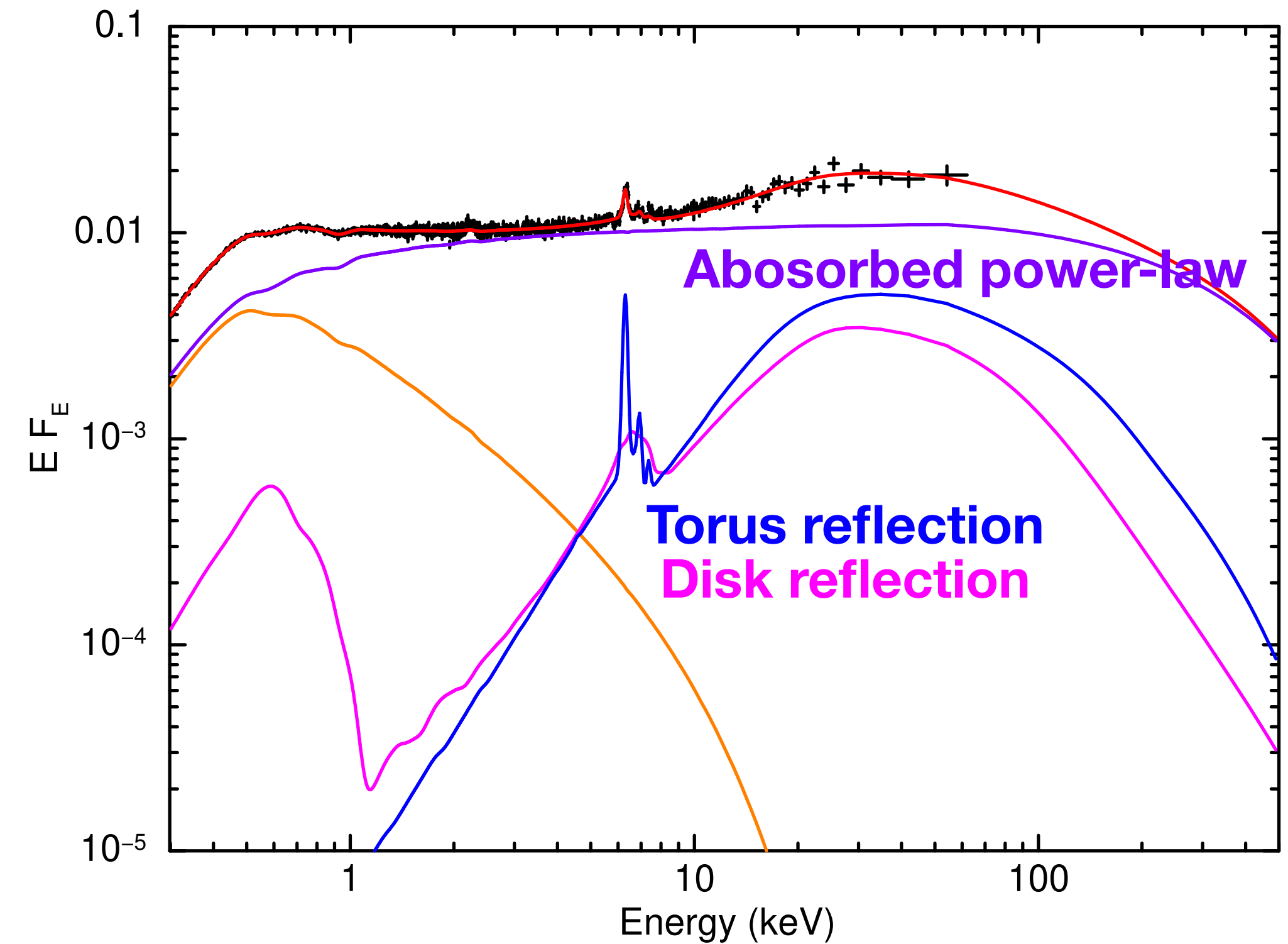
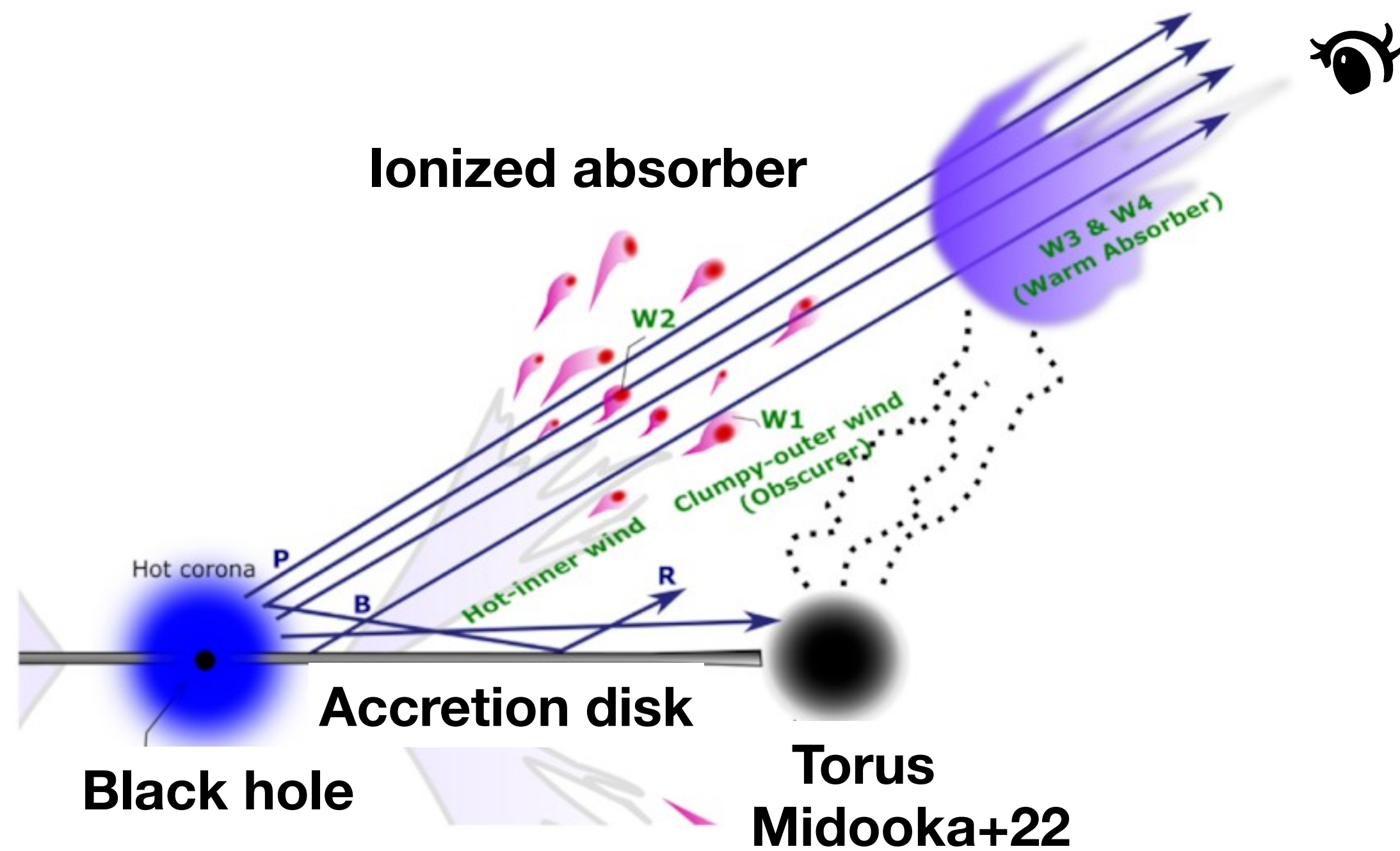
# AGN Structure



## AGN Structure

- ❖ Supermassive blackhole, Accretion Disk, Torus, Outflow
- ❖ Revealing structure of AGN is important for understanding AGN feeding/feedback mechanisms

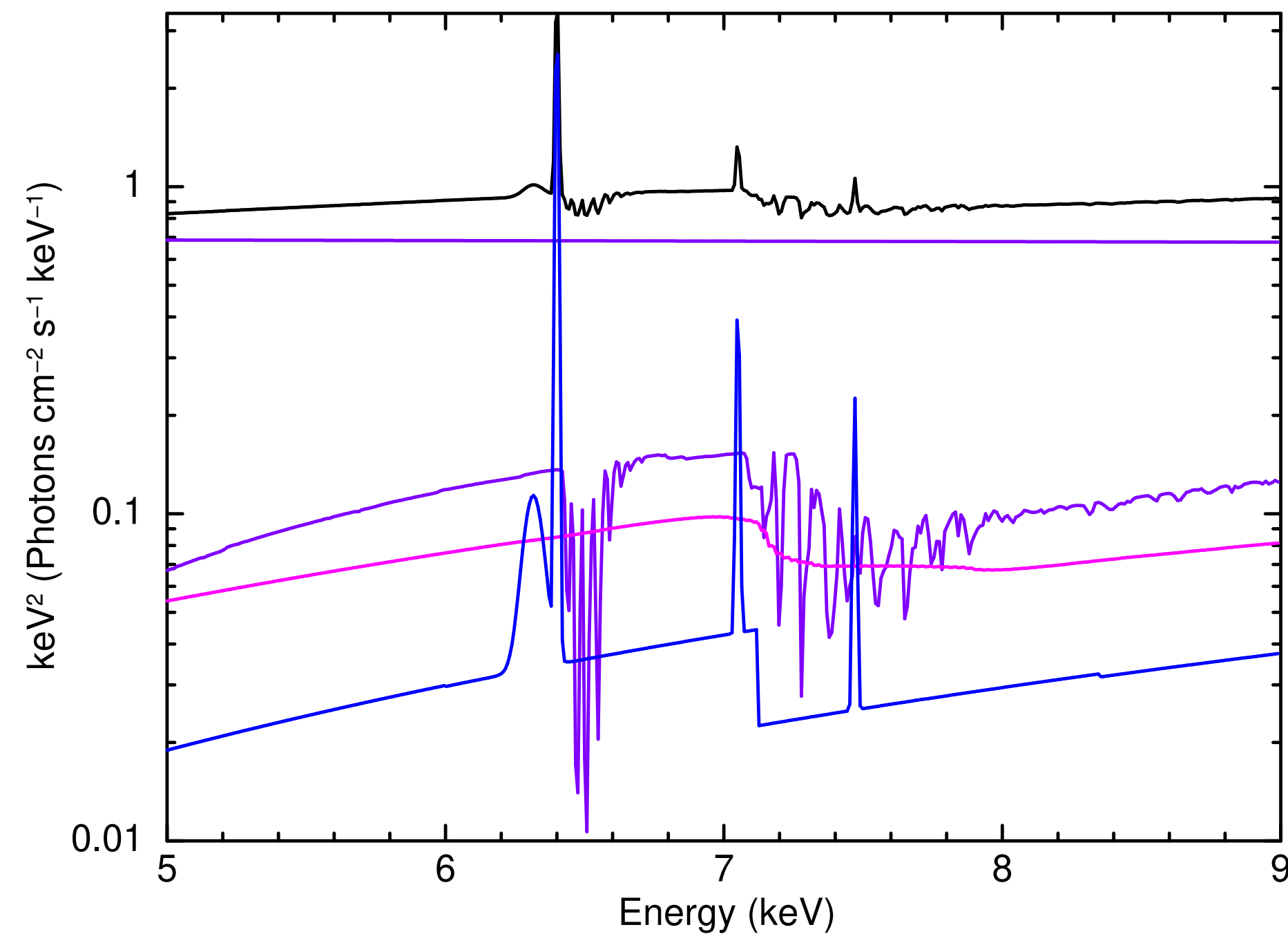
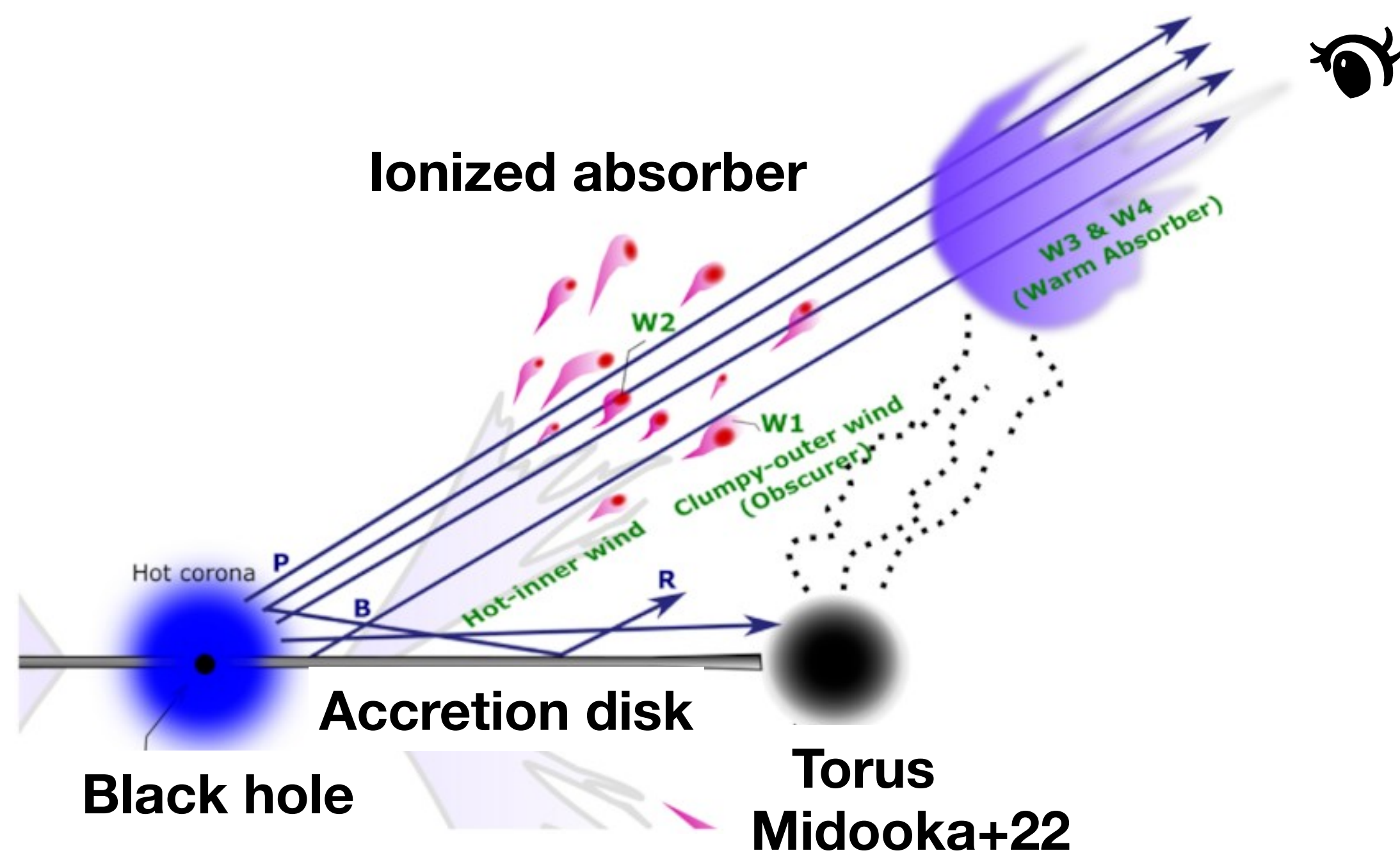
# X-ray Spectrum of AGN



X-ray spectrum of an AGN carries information on:

- ✿ All material with various temperatures and ionization states
- ✿ Line-of-sight materials (absorption feature)
- ✿ Torus and/or accretion disk (reflection component)

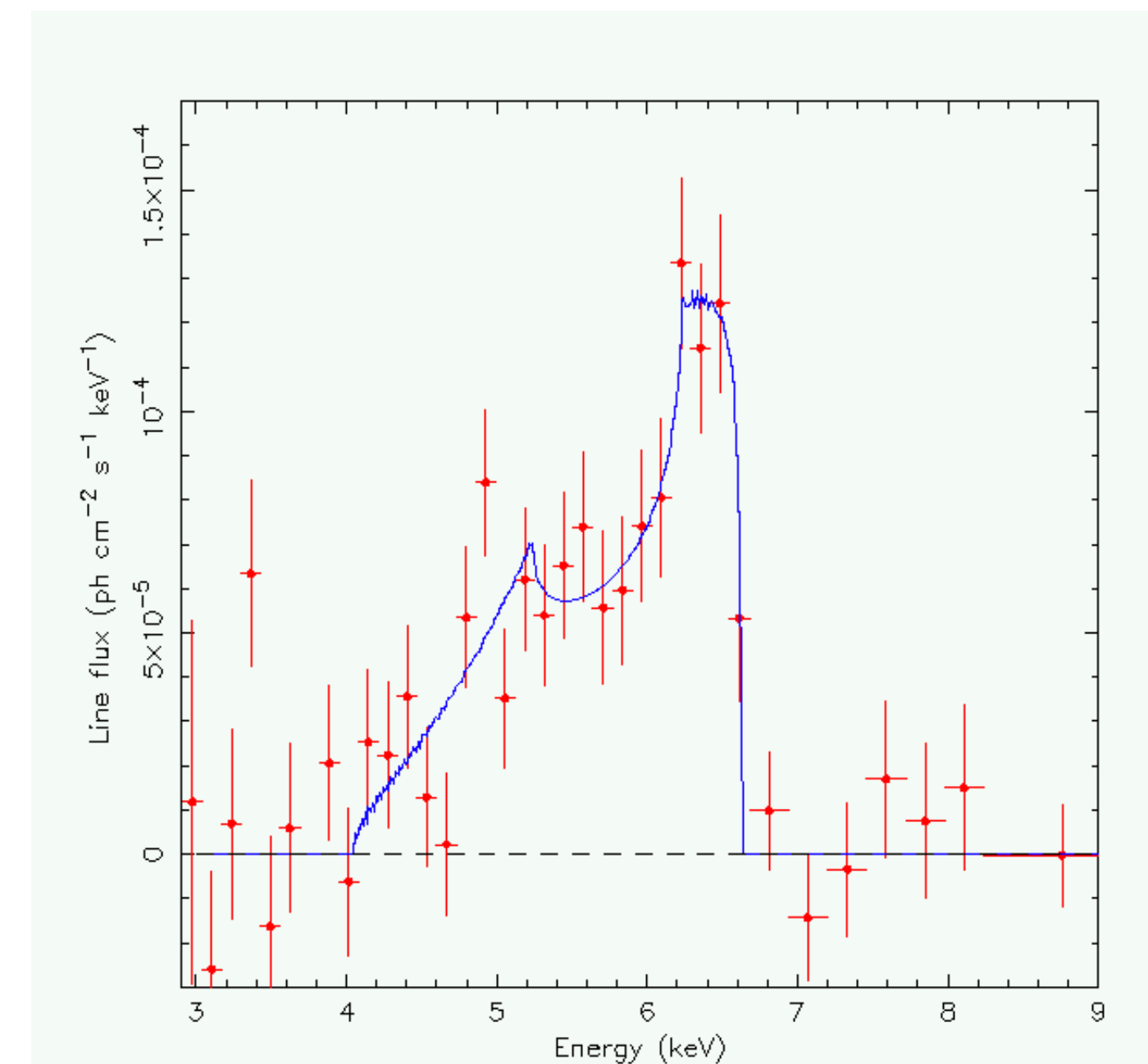
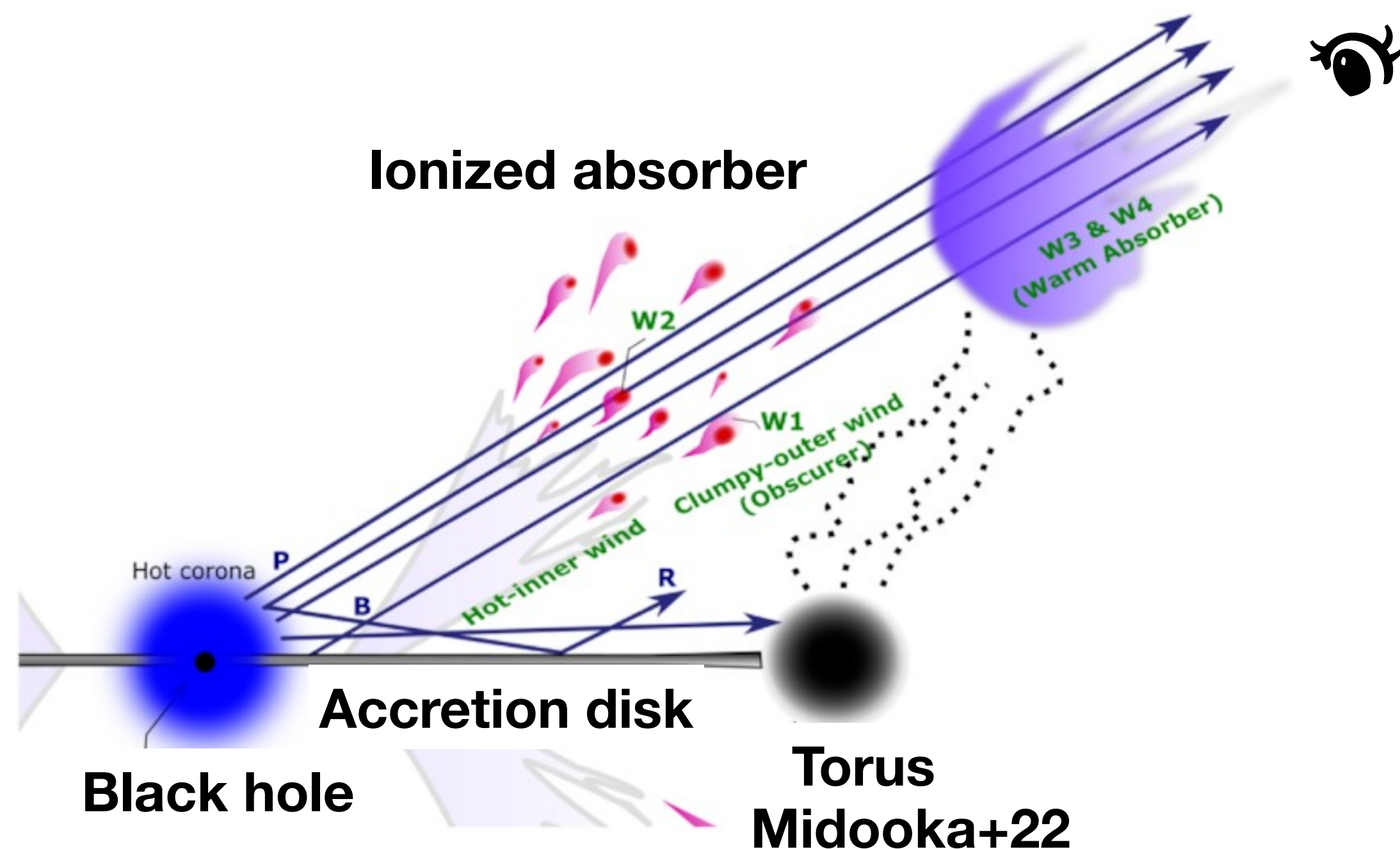
# Aim of This Research



## Spectral Complex in Fe-K band:

- ✿ Torus (disk) reflection accompanied by narrow fluorescence emission lines (Fe K $\alpha$ @6.4 keV)
- ✿ Relativistic reflection from innermost region of the accretion disk
- ✿ Absorbed direct component
- ✿ XRISM/Resolve enables us to separate these component

# Broad Fe K $\alpha$

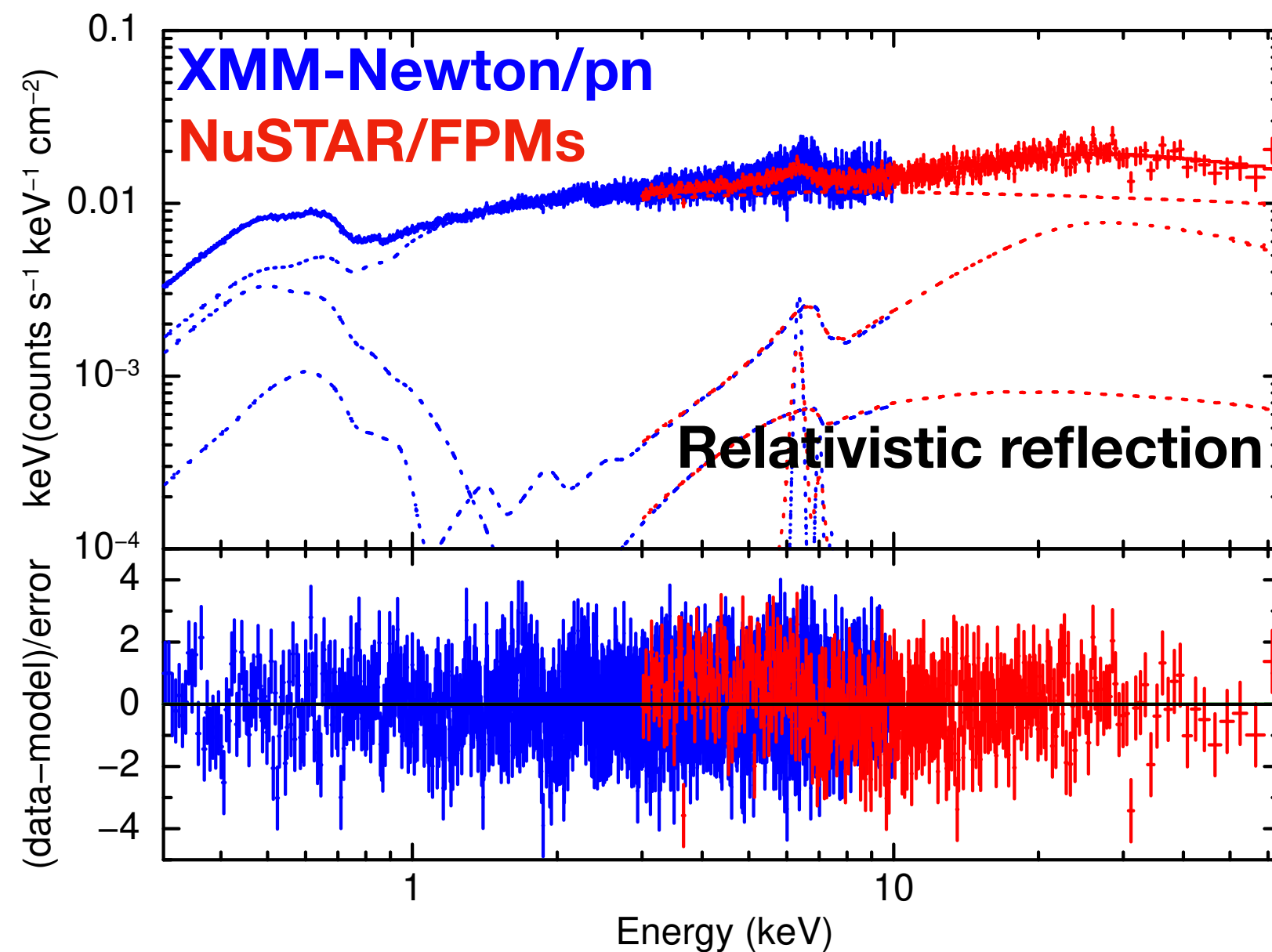


The line profile of Fe K $\alpha$  observed by the ASCA (Tanaka+95)

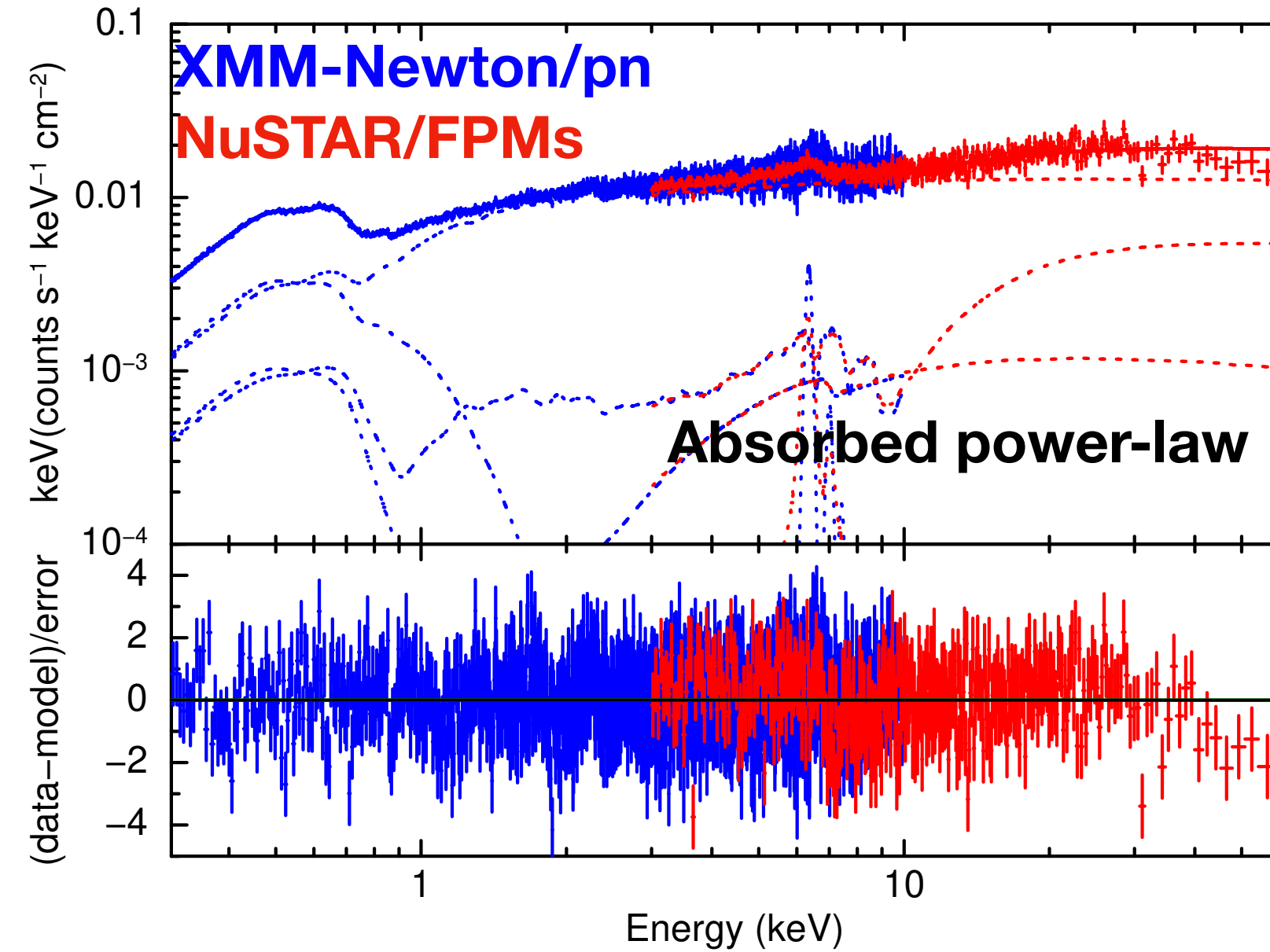
## Relativistic reflection from innermost region of the accretion disk

- ✿ Line profile of broad Fe K $\alpha$   $\rightarrow$  Black hole spin
- ✿ The intensity and profile of the line feature strongly depend on continuum modeling
- ✿ Absorbed Continuum shape can mimic Broad Fe K $\alpha$  with current CCD energy resolution
- ✿ Narrow features associated with ionized absorbers can be easily detected with XRISM/Resolve

# Target: MCG-6-30-15



**Relativistic reflection model**



**Partial covering model**

MCG-6-30-15 is an archetypical Seyfert 1 galaxy showing:

- ❖ Complex absorption
- ❖ Broad Fe K $\alpha$  emission
- ❖ Variability in flux and spectral shape
- ❖ Two spectral model (relativistic reflection, Tanaka+95; partial covering, Miyakawa+12)

# Joint Observation

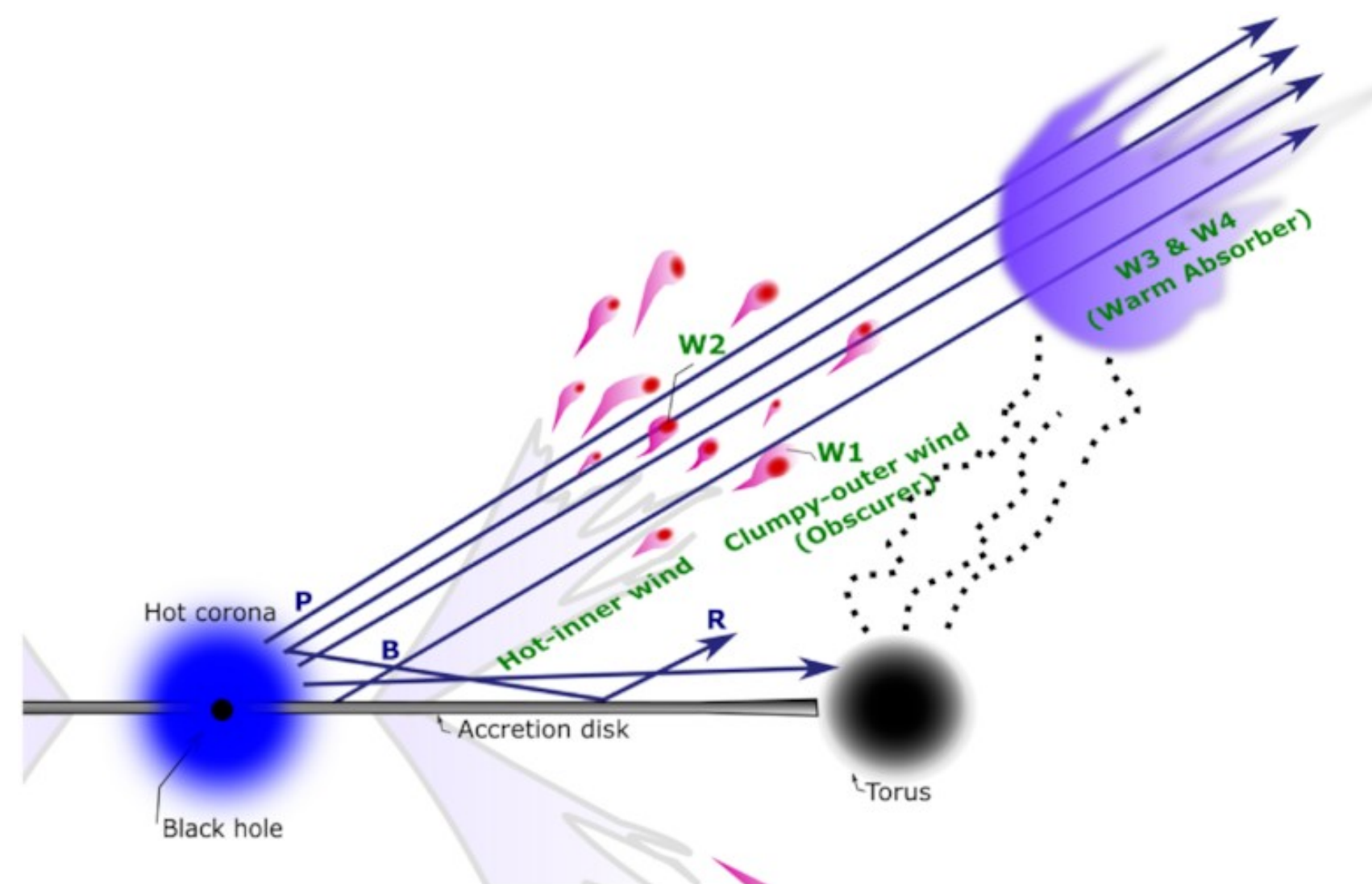
## Joint observation

- ✿ NuSTAR: continuum shape
- ✿ Chandra or XMM-Newton
  - Soft X-ray band (LETG, RGS): lower ionized gas
  - UV (XMM-Newton/OM): photoionization continuum

## Prospects

- ✿ Complete picture of ionized outflows
  - Ionization Parameter
  - Velocity

→ Revealing the structure of AGN



**Midooka+22**

# Summary

## Aim of this research:

- ✿ To detect narrow features associated with ionized outflows and reveal their physical properties
- ✿ To separate between these narrow spectral features and the relativistic reflection signals from the accretion disk (if any)
- ✿ To correctly determine the innermost disk radius and black-hole spin from the "disk-line" profile

## Long-term Observation of MCG-6-30-15

- ✿ To perform spectral fit to Intensity-sliced spectra
- ✿ To detect absorption features
- ✿ To test if partial absorber model is suitable