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**PROPERTIES OF THE IONIZED GAS IN EXO 0748-676**
Ionized gas in binary systems

- High-resolution spectroscopy allowed us to detail the gas environment of binary systems.
  - Relativistic effects (e.g. Cottam +2001)
  - Magnetic effects (Miller+2006)
  - Geometry of the system in dippers (e.g. Boirin+2005, Diaz-Trigo +2006)
EXO 0748-676

- Extensively studied LMXB
  - Dipper → undergoes obscuration periods aside from normal eclipses (e.g. Parmar +86)
  - Burster → single and triple bursts (Boirin+07)
The XMM-data set

- Collection of 17 observations, grouped according to equal flux and equal spectral parameters.
- Focus on RGS data only (PN used for broad band continuum)
- Study of the dipping and persistent states
  - dipping phenomenon
  - physical parameters of the gas
  - MORE?
Dips and persistent emission

Persistent Dipping

OVIII
OVII-Fe UTA

Persistent

Dipping

OVIII
OVII-Fe UTA
The photoionized gas

Column density of the photoionized gas systematically increases while ionization parameter $\xi$ decreases for each epoch. → Consistent with the idea that dipping is caused by a bulge of denser material intercepting our line of sight.
Geometry of the PI gas

Shell-like gas

The persistent gas is a trailing tail of the dipper bulge.

Comparing emission and absorption
(with some assumption on the luminosity and density)

Flattening of the gas: $18^\circ$

Distance of the gas: $R \sim \text{few} \times 10 \text{ cm} \sim L_1$
Going deeper with the spectral analysis

A second photoionized absorber fails to reproduce the OVII edge + iron UTA
Collisionally ionized gas

A collisionally ionized absorber correctly fits the spectrum:
In a CI gas for each temperature a peak ion exist: OVII @ T~70 eV
The collisionally ionized gas
The nature of the Ci gas

- Column density of gas increase during dips, while temperature remains constant
  ➔ Phenomenon intrinsic to the source and associated with dipping
  ➔ Is it associated with a circumbinary disc?
A circumbinary disk? (1)

- Where is located the CI gas?
  - Far enough not to be photoionized
  - \( R > 1 \times 10^{11} \) cm
  - High density \( n > \text{few} \ 1 \times 10^{14} \text{ cm}^{-3} \) (emission lines are consistent with this picture)
  - Very small layer of gas (150 km!) or a smoke-like medium (i.e. low filling factor)
A circumbinary disk? (2)

- **Cold** CB disks are detected in IR in CV, novae (Deufel +99) and XRB (Muno & Mauerhan 06)
- Disk extension is > twice the accretion disk

- Strong constraint on the distance, as thermal velocity can reach easily the escape velocity

  \[ R_{CI} \sim \text{few } \times 10^{11} \text{ cm} \]

- Are we detecting the first portion of a circumbinary disk?
Conclusions

- The photoionized gas in EXO 0748-676 behaves consistently with the picture of Boirin+05.
- The gas is located at ~few×10 cm, consistent with L1 and it has a flattened geometry.
- We detected for the first time a collisionally ionized plasma, which might be the first portion of a circumbinary disk.