



X-RAY ASTRONOMY 2019

Current Challenges and New Frontiers in the Next Decade

8-13 September 2019
CNR/INAF Research Area, Bologna, Italy

Contribution ID: 106

Type: **Poster**

X-ray Reverberation Mass Measurement of Cygnus X-1

Friday, 13 September 2019 15:28 (2 minutes)

Both galactic and supermassive black holes display characteristic features in their energy spectra, including an Fe $K\alpha$ line and a Compton hump, that result from reprocessing of hard X-ray photons by the accretion disk. This reflected emission provides a probe of the innermost region of the accretion disk through general relativistic distortions to the line profile. However, these spectral distortions are insensitive to black hole mass, since they depend on disk geometry in units of gravitational radii. Measuring the reverberation lag resulting from the difference in path length between direct and reflected emission gives a measure of absolute photon path length differences. Therefore the length of the gravitational radius can be calibrated by a combined spectral-timing analysis, providing a means to measure black hole mass. I will present the application of our new reverberation model to RXTE data from the black hole X-ray binary Cygnus X-1. We jointly fit the time-averaged X-ray spectrum and the real and imaginary parts of the cross-spectrum as a function of energy for a range of Fourier frequencies, in order to constrain the mass of the black hole. I will show how introducing a radial ionisation profile in the disk changes our results and I will compare our reverberation mass measurement with the dynamical mass measurement of Cygnus X-1.

Topic

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Session Classification: POSTER SESSION