Monitoring the short-term variability of Cyg X-1 with RXTE

K. Pottschmidt, J. Wilms, R. Staubert (IAA Tübingen), M.A. Nowak (JILA), J.B. Dove (Metropolitan State College of Denver), W.A. Heindl (CASS, UCSD), D.M. Smith (SSL, UCB)

For stellar black hole candidates several distinct states can be identified that differ in their general spectral and temporal properties. Based mainly on spectral arguments the states have been associated with different accretion rates and geometries. With broad band instruments like RXTE it is now possible to study the canonical black hole states with high time resolution over a time base of several years.
We analyzed the hard, i.e., most common, state of Cyg X-1, using RXTE observations that were performed from 1996 to 1999. The focus of our work lies on parameters and functions characterizing the short-term variability ($< 1000\,\mathrm{sec}$), like:
a) Power Spectral Densities (PSDs).
b) Linear State Space Models. According to these stochastic models, one typical relaxation timescale can be attributed to the hard state lightcurves of Cyg X-1.
c) Fourier frequency dependent quantities describing the relationship between different energy bands, namely coherence functions and timelags.
We find that the timing properties show a considerable variability, even though the state does not change. This has already been noted for PSDs, but is probably even more pronounced for the timelags. We also show how the changes relate to spectral parameters such as power law indices, coronal temperatures or reflection hump strengths.