

the companion star may play a role in causing these long-term changes in the accretion rate.

After a decade of continuous operation, the ASM continues to scan most of the celestial sphere several times per day (Levine et al. 1996). It has discovered 8 BHB/BHC X-ray novae and an additional 15 recurrent outbursts. Detailed X-ray light curves have been archived for each of these sources, and complete outbursts for six such systems are shown in §5.

3.2 X-ray Timing

Our most important resource for examining the near-vicinity of a BH is the rapid variations in X-ray intensity that are so often observed (van der Klis 2005; McClintock & Remillard 2006). The analysis tool commonly used for probing fast variability is the **power-density spectrum (PDS)** (e.g., Leahy et al. 1983). Related techniques for computing **coherence** and **phase lag** functions are reviewed by Vaughan & Nowak (1997). PDSs are interpreted with the presumption that the source variations are a locally stationary process. More generalized considerations of **time series** analyses are given by Scargle (1981), while recent topics in non-linear processes are well described by Gliozzi, Papadakis, & R  th (2006).

The PDS is used extensively in this work. The continuum power in the PDS is of interest for both its shape and its integrated amplitude (e.g., 0.1–10 Hz), which is usually expressed in units of rms fluctuations scaled to the mean count rate. PDSs of BHBs also exhibit transient, discrete features known as quasi-periodic oscillations (QPOs) that may range in frequency from 0.01 to 450 Hz. QPOs are generally modeled with **Lorentzian profiles**, and they are distinguished from broad power peaks using a **coherence parameter**, $Q = \nu / FWHM \gtrsim 2$ (Nowak 2000; van der Klis 2005). PDSs are frequently computed for a number of energy intervals. This is an important step in linking oscillations to an individual component in the X-ray spectrum.

3.3 X-ray Spectra

It has been known for decades that the energy spectra of BHBs often exhibit a composite shape consisting of both a thermal and a nonthermal component. Furthermore, BHBs display transitions in which one or the other of these components may dominate the X-ray luminosity (see Tanaka & Lewin 1995; McClintock & Remillard 2006). The thermal component is well modeled by a multitemperature blackbody, which originates in the inner accretion disk and often shows a characteristic temperature near 1 keV (see §7). The nonthermal component is usually modeled as a power law (PL). It is characterized by a **photon index Γ** , where the photon spectrum is $N(E) \propto E^{-\Gamma}$. The PL generally extends to much higher photon energies (E) than does the thermal component, and sometimes the PL suffers a break or an exponential cutoff at high energy.

X-ray spectra of BHBs may also exhibit an **Fe $K\alpha$ emission line** that is often relativistically broadened (§8.2.3). In some BHBs, particularly those with inclinations that allow us to view the disk largely face-on, the spectral model requires the addition of a **disk reflection** component (e.g., Done & Nayakshin 2001). In this case, the X-ray PL is reflected by the accretion disk and produces a spectral bump at roughly 10 to 30 keV. Finally, high-resolution **grating** spectra of BHBs sometimes reveal hot gas that is local to the binary system (e.g., Lee et al 2002).