

Table 2: Outburst states of black holes: nomenclature and definitions

New State Name (Old State Name)	Definition of X-ray State ^a
Thermal (High/Soft)	Disk fraction $f^b > 75\%$ QPOs absent or very weak: $a_{\text{max}}^c < 0.005$ Power continuum level $r^d < 0.075^e$
Hard (Low/Hard)	Disk fraction $f^b < 20\%$ (i.e., Power-law fraction $> 80\%$) $1.4^f < \Gamma < 2.1$ Power continuum level $r^d > 0.1$
Steep Power Law (SPL) (Very high)	Presence of power-law component with $\Gamma > 2.4$ Power continuum level $r^d < 0.15$ <i>Either $f^b < 0.8$ and 0.1–30 Hz QPOs present with $a^c > 0.01$ or disk fraction $f^b < 50\%$ with no QPOs</i>

^a2–20 keV band.^bFraction of the total 2–20 keV unabsorbed flux.^cQPO amplitude (rms).^dTotal rms power integrated over 0.1–10 Hz.^eFormerly 0.06 in McClintock & Remillard (2006).^fFormerly 1.5 in McClintock & Remillard (2006).

neutral gas. McClintock & Remillard (2006) used four parameters to define X-ray states: (1) the **disk fraction f** , which is the ratio of the disk flux to the total flux (both unabsorbed) at 2–20 keV; (2) the PL photon index (Γ) at energies below any break or cutoff; (3) the **rms power (r)** in the PDS integrated from 0.1–10 Hz, expressed as a fraction of the average source count rate; and (4) the integrated **rms amplitude (a)** of any QPO detected in the range 0.1–30 Hz. PDS criteria (a and r) utilize a broad energy range, e.g., the bandwidth of the RXTE PCA instrument, which is effectively 2–30 keV. Quantitative definitions of the three states are given in Table 2.

In the thermal state (formerly high/soft state, and “thermal dominant” state in McClintock & Remillard 2006) the flux is dominated by the heat radiation from the inner accretion disk, the integrated power continuum is faint, and QPOs are absent or very weak (see Table 2). There is usually a second, nonthermal component in the spectrum, but its contribution is limited to $< 25\%$ of the flux at 2–20 keV. The state is illustrated in the middle row of panels in Figure 2. The spectral **deconvolution** shows that the thermal component (*red line*) is much stronger than the PL component (*blue dashed line*) for $E \lesssim 10$ keV. The PDS (*right panel*), which is plotted in terms of $\log(\nu \times P_\nu)$ versus $\log \nu$, appears featureless. Similar displays of paired energy spectra and PDSs for nine other BHBs/BHCs in the thermal state are shown in McClintock & Remillard (2006).

The hard state (formerly low/hard state) is characterized by a hard PL component ($\Gamma \sim 1.7$) that contributes $\geq 80\%$ of the 2–20 keV flux (Table 2). The power continuum is bright with $r > 0.1$ and QPOs may be either present or absent. A hard state observation of GRO J1655–40 is shown in the bottom row of panels in Figure 2. The accretion disk appears to be faint and cool compared to the thermal state. As noted previously (§4.1), the hard state is associated with the presence of a quasi-steady radio jet, and clear correlations between the radio and X-ray intensities are observed.