Power spectra of black holes and neutron stars as a probe of hydrodynamical structure of the source. Diffusion theory and its application to X-ray observations of compact objects (black holes and neutron stars)

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I present a model of Fourier Power Density Spectrum (PDS) formation in accretion powered X-ray binary systems derived from the first principles of the diffusion theory. The resulting PDS continuum is a sum of two components, a low frequency (LF) component is presumably originated in an extended accretion disk and a high frequency (HF) component is originated in the innermost part of the source (Compton cloud).

The LF PDS component has a power law shape with index about 1.5 at higher frequencies (red noise) and a flat spectrum below a characteristic (break) frequency (white noise). This white-red noise (WRN) continuum spectrum holds information about physical parameters of bounded extended medium, diffusion time scale and dependence of viscosity vs radius. I present a method to measure an effective Reynolds number, Re using the basic PDS parameters (PDS index and characteristic frequencies). The inferred Re using the best-fit parameters of PDS is in the range of 8 ±2.5.