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Random-walk variability of AGN from lowest to highest accretion rates

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We study the variability structure function of AGN from optical light curves of two samples, using ~500 Southern Seyfert 1 to 1.8 nuclei at z<0.1 from the 6dF Galaxy Survey, and the ~5,000 brightest QSO in the sky at z=[0.5;2.5]. In both samples, we find that a fixed amplitude is reached on a timescale related to the expected orbital or thermal timescale of the accretion disc. At low black-hole mass, this involves the expected scaling due to faster orbital motions with increasing mass, but at higher masses, among the most luminous QSOs, the mass dependence seems to disappear. This is corroborated by numerical calculations of accretion disc emission approximating a GR regime, where the timescales turn over from decreasing with higher BH mass to increasing as the growth of the ISCO outpaces the orbital speed increase at fixed radius. We discuss remaining uncertainties of timescales from BH spin, disc inclination and dust extinction. Finally, we present our observations of damping timescales around low-mass black holes.

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