

Central black hole masses in ultraluminous X-ray sources

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Ultra-luminous X-ray sources (ULXs) are off-nuclear X-ray sources in nearby galaxies with X-ray luminosities $L_X > 10^{39}$ erg s⁻¹. The estimates of black hole (BH) masses of ULXs is a long-standing problem. Here we estimate BH masses of ULXs from both the X-ray photon index and X-ray variability using the correlations derived from reverberation mapping active galactic nuclei (AGNs), and discuss whether the results are in agreement with each other. We find that some high-luminosity ($L_X > 10^{40.5}$ erg s⁻¹) ULXs contain the BH of 10^4 - $10^5 M_\odot$. While the X-ray variability for some low-luminosity ($L_X < 10^{40.5}$ erg s⁻¹) ULXs suggests larger masses, which are in conflict with that from X-ray photon index. This may indicate that some low-luminosity ULXs generally accrete at different rate as luminous AGNs, or they have different power spectral densities of X-ray variability.

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We discuss two methods to estimate black hole (BH) masses using X-ray data only: from the X-ray variability amplitude and from the photon index Γ .

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