Abstract

There are observed many different types of black holes with a large range of masses, from black holes with about ten times the mass of our Sun to black holes with $10^9$ or even $10^{10}$ times the mass of our Sun. Stellar mass black holes can be observed when they come in binary systems, by radiation from matter from the companion star that accretes upon them and by radiation from jets that are sometimes launched. Supermassive black holes, with masses between $10^6$ and $10^{10}$ $M_{\text{sun}}$, live in the centers of active galaxies and also radiate from accretion and jets. Here I test if accretion and jet physics scale with black hole mass. This will be done by using a computer model to fit the observed multiwavelength emission from accreting black holes. I first fit the radiation from the black hole X-ray binary GX 339-4 ($10 M_{\text{sun}}$) to demonstrate that the model works at low masses. Then, for the first time, I attempt to apply the model to a $10^9 M_{\text{sun}}$ accreting black hole, namely the BL Lac object S5 0716+714. A BL Lac is used to test the high-mass end because of its special orientation, with its jet pointed directly towards the Earth. Because of this, the emission from the jet will outshine emission from the rest of the accreting black hole system, which minimizes the number of emission components to model, which makes a BL Lac object an excellent test case. A good fit to S5 0716+714 will provide strong support that accretion and jet physics indeed scale with black hole mass. A poor fit will indicate that there might be important differences between different mass black holes.