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Unrobing 'Dressed' Black Holes in Galactic Nuclei

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From the event horizon of a massive black hole in a galactic nucleus to the radius on which stars dominate the gravitational potential is a dynamic range of 10^7. Not surprisingly, the structure of such a galactic nucleus changes greatly over this span of scales. Through a combination of observational data and theoretical reasoning, we now know about many of the principal features. Thick clouds of molecular gas and dust occupy a toroidal region on the largest scale; examples have been interferometrically imaged in the infrared and in H_2O maser emission. This toroidal symmetry makes active galactic nuclei differ drastically in appearance depending on our viewing angle. Hot outflowing ionized gas occupies the axial hole in the torus, made visible by polarizing reflection of light from deeper inside and X-ray absorption spectroscopy. A factor of 1000 closer in, UV emission features indicate the presence of cooler ionized gas moving at $0.01c$. In some cases, we see evidence for outflows travelling at $0.1c$ at roughly the same distance scale. Still closer to the center, large-scale numerical simulations now show us how matter flows toward the black hole as a result of magnetic stresses created by internally-generated MHD turbulence. Thermal UV emission and hard X-rays created in coronal regions carry off the accreting matter's lost energy. Immediately outside the event horizon, spinning black holes can seize on the magnetic field created in the flow to transfer their angular momentum to matter in the inflow or drive a relativistic axial outflow.