

Fundamental Physics Prospects with the Event Horizon Telescope

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The Event Horizon Telescope (EHT) has opened a new observational window into the strong-gravity regime by resolving horizon-scale emission from the supermassive black holes M87* and Sgr A*. These observations provide a unique opportunity to probe spacetime geometry in the immediate vicinity of black holes and explore fundamental physics under extreme conditions. In this talk, I will discuss the prospects of EHT observations for testing general relativity and exploring physics beyond it. I will review how the black-hole shadow, critical curve, photon ring, and polarization signatures encode information about the underlying spacetime and can be used to test the Kerr hypothesis and constrain alternative theories of gravity. I will also discuss the role of the accretion environment—including plasma, magnetic fields, and the structure of radiatively inefficient accretion flows—in interpreting horizon-scale observations. Finally, I will highlight emerging particle-physics applications, including axion–photon conversion and other new-physics effects that can influence photon propagation and polarization near black holes. I will conclude by highlighting how the improved sensitivity, angular resolution, polarimetry, and dynamic-imaging capabilities of the next-generation EHT can help disentangle gravitational, astrophysical, and particle-physics signatures, making black-hole imaging a powerful laboratory for fundamental physics.