**Probing Strong Gravity and Accretion Physics with the Event Horizon Telescope**

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**Introduction**

The Event Horizon Telescope (EHT) is a Very-Long Baseline Interferometry (VLBI) project consisting of radio telescopes around the world. It has been resolving event horizon-scale structure in the vicinity of our galaxy’s Supermassive Black Hole (SMBH) Sgr A*\([9]\) as well as that of elliptical galaxy M87\([9]\) in the Virgo cluster.

In this work\(^{[9]}\), we simulate VLBI observations in order to assess the capability of the EHT to detect signatures of strong gravity and distinguish models of the accretion flow. In these simulated experiments, we explore...

- Two different targets, Sgr A* and M87.
- The addition of telescopes and other technological advances.
- Two different frequencies, 230 and 345 GHz.
- The addition of “closure phase” information, a powerful interferometric observable.

**Results**

**Strong Gravity: Detecting the Photon Ring**

Optically thin black hole images show a bright ring of emission, corresponding to the circular photon orbit predicted by general relativity.\(^{[8]}\) We predict that the EHT will soon be able to detect expected levels of photon ring flux. This is easier if observations are made at 345 GHz rather than 230 GHz, and/or if closure phase information is included.

**Accretion Physics: Distinguishing Models**

The EHT may be capable of distinguishing different accretion models with current telescopes—even very similar ones like 90h and MBD above! Soon, additional baselines, higher bandwidth, and closure phase information will only increase its constraining power. Making these distinctions allows us to determine properties of the black hole and its accretion flow such as its spin parameter and inclination.

**Accretion Physics: Structural Variability**

The flux of Sgr A* varies on 8 hour time scales, and simulations predict that its structure can fluctuate wildly. We determine that the EHT is guaranteed to detect signs of time-variability, if present, even in the most stable of simulations.

**The Future of the EHT**

- More Telescopes: Improve (u,v) coverage, higher resolution
- Higher Frequency: Mitigate blurring, probe small structure
- M87: Circumvent blurring, explore different black hole
- Greater Bandwidth: Improve signal to noise
- Closure Phases: Obtain highly precise phase information

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**References**