URSI GASS 2023, Sapporo, Japan, 19 – 26 August 2023

Overview of Event Horizon Telescope achievements: Supermassive Black Holes and Relativistic Jets

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The Event Horizon Telescope (EHT) has ushered in a new era for observing the strong gravitational field in the vicinity of a black hole. The EHT is the global very long baseline interferometry (VLBI) array at 1.3 mm (230 GHz) that constitutes a virtual Earth-sized telescope by combining radio telescopes worldwide. With the unprecedented angular resolution, the EHT Collaboration has explored the horizon-scale emission near the supermassive black holes: M87* at the nearby radio galaxy M87 [1] and Sagittarius A* (Sgr A*) at the Galactic center [2].

In 2019, The first-ever horizon scale image of M87* has provided by the EHT Collaboration (left panel of Figure 1, [1]). The image showed the compact ring-like feature, consistent with the theoretical expectation of general relativity. Further observational and theoretical analysis of the polarization image in the vicinity of the black hole has provided detailed information on the magnetic field structure and strength, which is essential to understand the origin of the accretion flow and relativistic jet.

In 2022, the EHT Collaboration has revealed the horizon scale image of Sgr A* (right panel of Figure 1, [2]). The ring-like image morphologies of M87* and Sgr A* showed observational consistency with the theoretical expectation of general relativity at two different types of galaxies and different black hole masses. With the unprecedented angular resolution, the EHT Collaboration also resolved the characteristics of relativistic jets of several bright Active galactic nuclei, including 3C 279, Centaurus A, and J1924-2914.

In this talk, we will review the state-of-art achievements of the Event Horizon Telescope Collaboration. We will explain the observational system and analysis utilized in the projects and physical interpretation using theoretical models and numerical simulations.

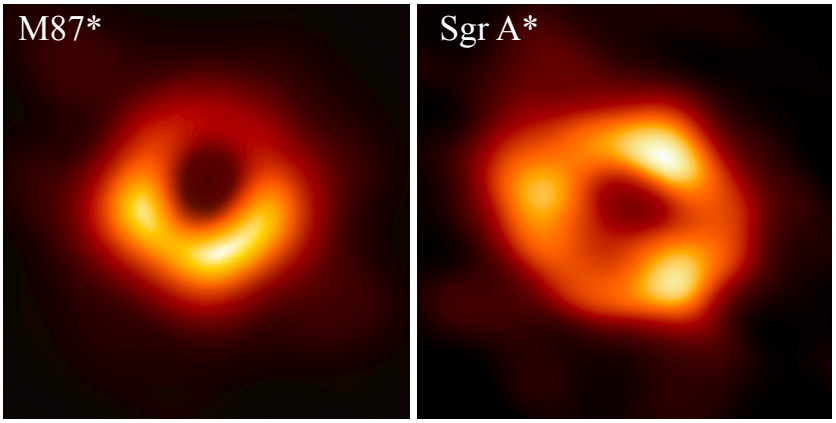

Figure 1. The representative horizon-scale images of the supermassive black holes M87* at the nearby radio galaxy (left panel) and Sagittarius A* (Sgr A*) at the Galactic center (right panel). Credit: Event Horizon Telescope Collaboration.

References

[1] Event Horizon Telescope Collaboration, Akiyama, K., Alberdi, A., et al. "First M87 Event Horizon Telescope Results. I. The Shadow of the Supermassive Black Hole" *ApJL*, **875**, L1, April, 2019, pp 17, doi: 10.3847/2041-8213/ab0ec7 (series of the papers: L1-L6)

[2] Event Horizon Telescope Collaboration, Akiyama, K., Alberdi, A., et al. "First Sagittarius A* Event Horizon Telescope Results. I. The Shadow of the Supermassive Black Hole in the Center of the Milky Way" *ApJL*, **930**, L12-17, May, 2022, pp 21, doi: 10.3847/2041-8213/ac6674 (series of the papers: L12-L17)