Contribution ID: **962** Type: **Talk in the parallel session**

Event Horizon Telescope Paper VIII: Dynamically Important Magnetic Fields at the M 87* Horizon

Monday, 5 July 2021 16:50 (20 minutes)

In 2017, the Event Horizon Telescope (EHT) observed the black hole at the center of the giant elliptical galaxy, Messier 87 using very-long baseline interferometry between a global network of radio telescopes. The resulting linearly polarized images of the accretion flow near the horizon of the black hole (M 87\) *show resolved polarized structure with a spiral pattern in the electric vector position angle. I will present the implications of these images for our understanding of accretion flows around supermassive black holes. In particular, I will present the theoretical analysis recently published by the EHT, in which the EHT image reconstructions were compared to ray traced images of general relativistic magnetohydrodynamic (GRMHD) simulations of M 87*\ according to five metrics: average linear polarization fraction, net linear polarization, net circular polarization, and the amplitude and phase of a complex coefficient corresponding to azimuthal structure in linear polarization, β_2. Regardless of the details of the scoring procedure used, only simulations with dynamically important fields, so-called magnetically arrested disks, yield images consistent with EHT observations while producing a jet of sufficient power. The polarized image constraints refine the previous EHT estimates of the M 87* accretion rate by an order of magnitude to the narrower range of $(3-20)\times 10^{-4} M_{\odot}\mathrm{yr}^{-1}$.

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Session Classification: Radio Astronomy from Space

Track Classification: Black Holes: Theory and Observations/Experiments: Radio Astronomy from Space