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# Towards Bayesian Inference of GRMHD model parameters from VLBI data

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Recent Event Horizon Telescope (EHT) observations of M87*and Sgr A* have proven to be an insightful data set to probe the spacetime and physical conditions in accreting supermassive black hole systems. For this purpose an ad hoc and fixed, pre-computed library of ~60,000 model images for M87*and about 1,800,000 for Sgr A* was used to sample black hole spin, magnetic flux on the horizon, inclination angle, and electron thermodynamics parameter Rhigh.

In this work we introduce the new capability of adaptive parameter estimation of models involving ray-traced images from given GRMHD simulations in a Bayesian scheme. The radiative transfer is done adaptively during the sampling via a Markov chain Monte Carlo (MCMC) algorithm without the need for a fixed model image library. We restrict the discussion here to an analysis with four parameters: accretion rate onto the black hole, electron temperature parameter Rhigh, observer viewing angle, and the position angle of the source on the sky.

We develop a pipeline by incorporating the general relativistic radiative transfer code ipole into the EHT parameter estimation tool THEMIS. The pipeline produces a ray-traced model image from GRMHD data, computes VLBI observables from the image for a specific VLBI array configuration and samples the likelihood surface via an MCMC scheme.

We find that our scheme recovers faithfully parameters from simulated data with known truth values and we illustrate its application to time variable models and datasets with more realistic errors.

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