

Probabilistic fringe-fitting and source model comparison

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Probability theory provides a uniquely valid set of rules for plausible reasoning, which enables us to apply it with greater flexibility to problems of scientific inference. Here, we take a probabilistic approach to fringe-fitting, in which we solve for time and frequency dependent phase variations introduced in VLBI observations by the interstellar medium and the Earth's atmosphere, by modelling them using the Radio Interferometry Measurement Equation (RIME) formalism. We also simultaneously estimate source structure and perform model selection between simple parametrised source models using Bayesian hypothesis testing. We test our method on Event Horizon Telescope (EHT) simulations with tropospheric phase corruptions introduced. We also explore ways in which this formalism may be applied to problems in astrometry and geodesy.