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Testing The Kerr Paradigm Through Synchrotron Radiation

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General Relativity has been tested in weak field regimes but in strong gravity regimes still to be verified. The strong gravity regime with synchrotron radiation is not yet explored. Synchrotron emission traces magnetic field and cosmic ray electrons. EHT observations show strong synchrotron radiation near black hole horizon. This paper presents test of strong gravity regime using synchrotron radiation. By adopting Cardoso, Pani, Rico (CPR) [Phys. Rev. D 89, 064007 (2014)], we first investigate effect of model parameters including spin parameter, inclination angle, magnetic field and nonthermal spectral index of synchrotron radiation of Kerr space time on photon flux number density. Then, we extend it to CPR space time as this model deviates from Kerr space time. We also mock 10 data observations. Using a bayesian inference approach we fit model parameters including spin and deformation parameters of CPR metric . We considered both Kerr and CPR space time as reference case of model comparison. Assuming uniform/gaussian prior for all parameters, we can constrain all parameters. Assuming gaussian prior for spin parameter and uniform prior for deformation parameters of metric, the spin parameter can be constrained but the deformation parameters can not be constrained. Thus, synchrotron radiation provide a tool to explore strong gravity regime.

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