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Bayesian inference for the nHz SGWB in PTA data analysis with ML

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Complex inference tasks such as those in Pulsar Timing Array (PTA) data analysis rely on Bayesian frameworks. The high-dimensional parameters space and the strong interdependencies among astrophysical, pulsar noise and nuisance parameters introduce significant challenges. We address two of them. The first focuses on speeding up the existing code for Bayesian inference by using NessAI, a nested sampling algorithm for Bayesian Inference that makes use of a ML algorithm designed for applications where likelihood is computationally expensive, as is the case for PTA. I will present the improvements obtained for the analysis of the 25 pulsars of EPTADR2 in the CURN model. The second, in collaboration with Koexai s.r.l., focuses on reducing the dependence of the posterior for the parameters of the nHz SGWB on the choice of the prior of the nuisance parameters by means of a ML-guided reparametrization in the parameters space.

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