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Searching for Gravitational Wave Bursts via Bayesian Nonparametrics Data Analysis with Pulsar Timing Arrays XIHAO DENG, The Pennsylvania State University — A pulsar timing array (PTA) acts to detect gravitational waves by observing the small, correlated effect the waves have on millisecond pulsar pulse arrival times at Earth. Gravitational wave bursts — signals whose duration is shorter than the observation period — are expected to be one of the candidate signals that would arise in the pulsar timing array. Sources generating such signals include the periapsis passage of compact objects in highly eccentric or unbound orbits about an supermassive black hole, gravitational wave memory with coalescence of supermassive black holes, cusps on cosmic strings, etc. It is the usual case that we do not know the exact analytical formulae of gravitational wave burst signals and we are not able to parameterize them. In order to detect such signals, we introduce a new method — Bayesian nonparametrics — to analyze pulsar timing array data, which takes advantage of the prior expectation we have rather than parameterized formulae to characterize the gravitational wave bursts. Our Bayesian nonparametrics analysis will investigate the odds that a gravitational wave burst is present in the data and also infer the sky location of the source and the shape of the signal induced by this burst.

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