The Geometry of the Pulsar Timing Array Ephemeris Error Problem

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Abstract

In order to detect the stochastic gravitational wave background, a pulsar timing array must measure a characteristic angular correlation between different pulsars. Errors in the planetary ephemeris are known to produce false positives, since they induce correlated timing residuals in different pulsars. But we know that the correlations have different shapes, so why is this a problem? I will discuss how finite-sized pulsar arrays cause contamination of the gravitational wave signal by planetery ephemeris errors and clock errors, and how this effect depends on the number, sky location, and quality of pulsars in the array. I will also discuss potential solutions based on this geometric understanding of the problem.

References

[1] Roebber, E. 2019, *Ephemeris errors and the gravitational wave signal: Harmonic mode coupling in pulsar timing array searches.* ApJ in press, arXiv:1901.05468.