

PHYSICS DEPARTMENT

COLLOQUIUM

“Pulsar timing array based search for supermassive black hole binaries in the SKA era”

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Abstract: The advent of next generation radio telescope facilities, such as the Square Kilometer Array (SKA), will usher in an era where a Pulsar Timing Array (PTA) based search for gravitational waves (GWs) will be able to use hundreds of well-timed millisecond pulsars rather than the few dozens in existing PTAs. A realistic assessment of the performance of such an extremely large PTA must take into account the data analysis challenge posed by an exponential increase in the parameter space volume due to the large number of so-called pulsar phase parameters. We address this problem and present such an assessment for isolated supermassive black hole binary (SMBHB) searches using a SKA era PTA containing 10^3 pulsars. We find that an all-sky search will be able to confidently detect non-evolving sources with redshifted chirp mass of $10^{10} M_{\odot}$ out to a redshift of about 28. The detection of GW signals from optically identified SMBHB candidates similar to PSO J334+01 is assured. If no SMBHB detections occur, a highly unlikely scenario in the light of our results, the sky-averaged upper limit on strain amplitude will be improved by about three orders of magnitude over existing limits.