



THE CHINESE UNIVERSITY OF HONG KONG
Department of Physics
SEMINAR

Probing Dark Matter with Pulsar Timing Arrays and Gravitational Wave Detectors

by

Mr. Vincent Sze Him LEE (李思謙先生)
Department of Physics
The California Institute of Technology, USA

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ALL INTERESTED ARE WELCOME

Abstract

Pulsar timing arrays (PTAs) and gravitational wave detectors can serve as valuable tools in the detection of dark matter. Dark matter substructure within the Milky Way Galaxy can induce gravitational pulls on pulsars, leading to observable deviations in pulsar timings. We demonstrate that dark matter models predicting enhanced power on small scales ($< \text{pc}$) are potentially within the reach of future PTA experiments, such as the Square Kilometer Array (SKA). This includes a class of post-inflationary QCD axion models known as axion miniclusters. We also discuss pipelines for searching for dark matter signals in PTA datasets and recent results from the 15-year data release of the North American Nanohertz Observatory for Gravitational Waves (NANOGrav), which has reported evidence of a stochastic gravitational background. Furthermore, dark matter particles with a mass on the kilogram scale can also produce signals in laser interferometry-based gravitational wave experiments. We discuss the signals and detection prospects from current and future gravitational wave experiments, such as LIGO and the Einstein Telescope.