PURDUE UNIVERSITY

Joint PQSEI-Particle Physics Seminar

Akio Kawasaki
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Dr. Akio Kawasaki received his Bachelor of Science degree from the University of Tokyo in 2010 and his PhD degree in 2017 from the Department of Physics, MIT, where he worked on a spin squeezed ytterbium atomic clock in Prof. Vladan Vuletic's group at the Center for Ultracold Atoms. He is currently a William M. and Jane D. Fairbank Postdoctoral Fellow with the W. W. Hansen Experimental Physics Laboratory and the Department of Physics at Stanford University. He is working on a measurement of short distance gravity performed by an optically leviated sphere and a non fabricated cantilever in Prof. Giorgio Gratta's group. His research interest lies in exploring fundamental physics with AMO techniques, such as spectroscopy of atoms involving anti-particles, gravitation wave detection by atomic interferometry, and measurement of g-2 for particles, parity non-conservation in nuclei and electron EDM.

"Search for non-Newtonian gravity with optically-levitated microspheres"

Tuesday, November 19, 2019
3:30 – 4:30 p.m.; PHYS 242

The universal law of gravity has undergone stringent tests for a long time over a significant range of length scale, from an atomic scale to a planetary scale. Of particular interest is the short distance regime, where modifications to Newtonian gravity may arise from axion-like particles and extra dimensions. We have constructed an ultra-sensitive force sensor based on optically-levitated microspheres with a force sensitivity of $\sim 10^{-17}$ N/√Hz for the purposed of investigating non-Newtonian forces in the 1-100 μm range. Microspheres interact with a variable-density attractor mass made by alternating silicon and gold segments with periodicity of ~50 μm. The attractor can be located as close as ~10 μm to a microsphere. In this presentation, I describe the characterization of this system, its sensitivity, and some preliminary results. In the course of the characterization of the system and the reduction of background, substantial efforts were made on controlling rotational degrees of freedom and measuring the mass of the trapped spheres, and these are also discussed. Further technological developments to reduce background are expected to provide orders of magnitude improvement in the sensitivity, going beyond current constraints on non-Newtonian interactions. (**Faculty Hosts: Yong Chen and Rafael Lang)**

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