Precision physics with ions in crystals

My group uses atomic ions inside crystals in order to search for new fundamental particles and interactions. Previous summer students have done experiments ranging from thermal engineering of ultrastable cavities, to building ion traps, to launching optical atomic clocks on a high-altitude balloon. You can see some of our recent work at uoft.me/vutha

2025 Summer Project

Probing ultra-high-energy physics using nuclear shapes

One of the biggest mysteries about the universe is why everything is made up of matter, but there is no natural antimatter anywhere. This surprising imbalance, between two entities that should behave identically under the known laws of physics, is one of the biggest open problems in physics. A clue to understanding this mystery may be obtained from precise measurements of symmetry-violating deformations of the shape of nuclei. Precision measurements on such nuclei can also sense dark matter waves produced by particles such as axions.

You will join a team that operates the most precise experiment of its kind in the word, in order to make a new measurement of time-reversal symmetry breaking in nuclei . This project requires practical common sense, sound fundamentals in E&M and quantum mechanics, and the ability to learn new skills rapidly.

Requirements

I like introducing students to the joys of experimental physics. You should be willing to learn new things, and enjoy building/fixing equipment. Prior experience tinkering with analog electronics, optics or mechanical fabrication will be helpful, though not essential.

Contact Amar Vutha (amar.vutha@utoronto.ca) if you are interested. *Be bold !*