Call for Applications for the Position of Summer Research Assistant: Optical Frequency Standards Program, Institute for National Measurement Standards (INMS), National Research Council of Canada

(Via Funding By: York University, Department of Physics and Astronomy)

Supervisor: Dr. Alan A. Madej

Project Title: Development of Methods for Improved Quantum State Preparation for the NRC Single Ion Experiment

The proposed summer research term would have the student assistant work in a laboratory environment at the Institute for National Measurement Standards (INMS) located at the National Research Council of Canada labs in Ottawa, ON. The work will aid in the development of activities associated with precision measurements in atomic physics and the generation of accurate optical reference frequencies. This work is done in support of the INMS mandate for research into fundamental standards of time and frequency.

The proposed project deals with the development, testing, and implementation of an optically injected locked laser diode system delivering 10's of mW of radiation resonant with a transition in a single trapped and laser cooled atomic ion. Work will be directed to optically phase lock this power laser diode to the NRC 674 nm ultra-stable probe laser system which provides one of the world's most frequency stable sources of coherent radiation. The radiation will then be used with an isolated single ion suspended in an electrodynamic trapping field to preferentially populate a single quantum state. Work may also be directed to preparing this quantum state using polarization controlled radiation or to examine the possible efficient low temperature laser cooling of the ion using this radiation. This work will be done in tandem with the newly developed INMS strontium single ion trap and will be used for future work in the characterization and implementation of atomic time realized through the use of a single isolated quantum system. The strontium single ion reference has been selected as an internationally recognized secondary realization of the second and thus this work will aid in the development of a potential optical atomic clock for realizing time at the highest accuracy possible. It will also allow for eventual precision tests of the time variance of physical constants of nature and measurements of relativistic gravitational effects at the sub-meter level. During the summer term, the student will develop skills in the manipulation of a wide variety of optical components for the control of Gaussian laser beams, gain experience with diode laser systems, and work with fiber optic systems and components. The student will also develop know-how with the principles of atomic clocks and the preparation of quantum states using various optical pumping techniques.

The anticipated work term would be from May to the end of August 2010 and would be supported from a York University, NSERC Grant at the rates of pay commensurate with the year of completion of the undergraduate student.

Deadline for applications : March 19, 2010

For more information please contact:
Dr. Alan Madej

E-mail : alan.madej@nrc.ca
Phone: (613) 993-9385