Master Thesis Project

In the ERC Synergy Grant Project "ThoriumNuclearClock" at LS Parodi/Garching, AG Thirolf

Upgrade of a Control System for the Thorium Isomer Gas-Cell Setup

"ThoriumNuclearClock" is an ERC Synergy Grant project that started in 2020, for a duration of 6 years. 4 international research teams (3 experimental: LMU Munich/Germany, PI: P.G. Thirolf, TU Vienna/Austria, PI: T. Schumm, PTB Braunschweig/Germany, PI: E. Peik; 1 theoretical: U Delaware/USA, PI: M. Safronova) join forces to build world's first optical nuclear clock and apply it to fundamental physics studies.

Project background:

Today's most precise time and frequency measurements are performed with optical atomic clocks. However, it has been proposed that they could potentially be outperformed by a nuclear clock, which employs a nuclear transition instead of an atomic shell transition. There is only one known nuclear state that could serve as a nuclear clock, namely, the isomeric first excited state of ^{229}Th which exhibits the lowest nuclear excitation so far reported in the whole landscape of known isotopes. In recent years drastic progress could be achieved in characterizing this elusive nuclear state, strongly driven by our experimental work in Garching, opening the door towards an all-optical control and thus the development of an ultra-precise nuclear clock. Such a nuclear clock promises intriguing applications in applied as well as fundamental physics, ranging from geodesy and seismology to the investigation of possible time variations of fundamental constants or the search for Dark Matter.

Project description:

The experimental backbone of our experiments is a multi-component setup, consisting of a buffer gas stopping cell with RF and DC guiding electrodes, a segmented radiofrequency quadrupole ion guide and a quadrupole mass separator. Hardware control (vacuum bakeout, vacuum pump operation, valve control, pressure gauge readout, RF and DC voltage settings) is presently performed via a storage programmable system (SPS) running in a complex setup and connected via phased-out controller cards to a control PC. This system can be considerably simplified and adapted to state-of-the-art standards by by an upgrade to modern hardware components. This will be the core of your thesis project.

Your tasks:

- Setup of an upgraded hardware control system, starting in parallel to the existing one
- Integration of the new components into a user-friendly graphical user interface
- participation in experimental activities at the buffer-gas stopping cell setup

If you are highly motivated to work in a dynamic and internationally highly visible project, like practical, hardware-oriented work in the laboratory together with programming-related tasks, then you are encouraged to apply to join our team for the described Master Thesis project.

Applications including a motivation letter, a CV and transcripts of grades should be sent to:

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