Building a Strontium Ion Trap Experiment for Precision Measurements and Quantum Communication

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Over the past two decades, trapped ions have proven to be one of the most promising physical systems for implementing quantum computing and precision measurements. The ability of scientists to isolate and manipulate single or multiple ions with outstanding precision has ushered in a new era in quantum physics, leading to significant breakthroughs in the use of trapped ions across various applications. Ion traps have become one of the few platforms capable of performing quantum logic gates, generating entangled states, and enabling novel quantum technologies. In metrology and high-precision frequency standards, optical clocks based on trapped ions reach short-term uncertainties on the order of 10^{-18}. Although versatile experiments for high-precision measurements are available in many countries, Brazil still lacks this singular tool. In this project, we are launching the first experimental group dedicated to trapped-ion research in Brazil with the construction of an ion trap system. In this poster, we describe the technical details of its construction and discuss our upcoming experiments on isotope-selective trapping and laser cooling toward the confinement of Strontium-87 (^{87}Sr).