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MARA Low-Energy Branch: A new facility for the study of exotic proton-rich nuclei

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The MARA low-energy branch (MARA-LEB) [1] is a novel facility currently under development at the University of Jyväskylä. The primary aim of MARA-LEB will be to study ground and isomeric-state properties of exotic proton-rich nuclei employing in-gas-cell and in-gas-jet resonance ionisation spectroscopy and mass measurements. Initially these studies will focus on nuclei close to the N=Z line and in the region of 100Sn which are of particular interest to the astrophysical rp process [2] and the study of the proton-neutron interaction [3], before expanding to other regions of the nuclear chart.
For the study of exotic nuclei, special experimental conditions are required to isolate the ions of interest from the overwhelming amount of unwanted nuclei produced during nuclear reactions. In MARA-LEB these conditions will be achieved by combining the MARA vacuum-mode mass separator [4,5] with a buffer gas cell, an ion guide system [6] and a dipole mass separator for stopping, thermalising and transporting reaction products to the experimental stations.
Resonance laser ionisation spectroscopy will be possible either in a separate region inside the gas cell or inside a hypersonic gas jet at the exit of the cell, which will allow for more accurate measurements [7]. A dedicated state-of-the-art Ti:Sapphire laser system will be used to provide reliable experimental data on the ground and isomeric-state properties of exotic isotopes.
Mass measurements will be achieved using a radiofrequency quadrupole cooler and buncher coupled to a multi-reflection time-of-flight mass spectrometer [8]. These devices will allow for fast and accurate mass measurements of several isotopes with high impact on the rp process or isotopes which can be used as test grounds for state-of-the-art nuclear models.
A dedicated high-efficiency decay station, in combination with the low-background ion signals available after laser ionisation or mass purification, will provide ideal conditions for detailed decay studies of the nuclei of interest.
In this presentation I will give an overview of the MARA-LEB facility and some of the key science cases, and present the outcome of preliminary tests.

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