Sources of positrons and protons

Thursday 4 April 2024 17:00 (30 minutes)

Positron and proton sources, and traps have played a pivotal role for the antimatter research taking place both in Vienna and at CERN as part of the ASACUSA collaboration.

At home in Vienna, we have designed and constructed a positron beamline which uses a conventional ²²Na source and Ne moderator to produce a beam which is trapped and conditioned for experiments in a Surko-type positron trap [e.g. 1,2]. This beamline is currently being commissioned after final safety clearances for operation to use the source in a residential area. We first aim to use the positron pulses from this trap to observe molecules containing positronium, such as PsH [3] and PsO [4] via collisions in gases such as methane and carbon dioxide. By using a high-resolution ion mass spectrometer to detect fragments from dissociation, a precise measurement of their binding energy will be performed.

We have also designed, built and characterised a proton source [5] for the ASACUSA collaboration with the aim of performing matter mixing experiments when antiprotons are not available. Using electron impact ionisation, protons are created via dissociative ionisation of H₂ gas. A rotating wall electric field destabilises the unwanted H_2^+ and H_3^+ generated during the dissociative ionisation process, while concentrating the protons in the centre of the trap. The source produces bunches of protons with relatively low ion contamination (5.5 % H_2^+ and 15.5 % H_3^+), with energy tuneable from 35 to 300 eV, and has already been used to transfer protons into the 'Cusp'trap at CERN.

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