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25 years of ultimate-resolution exotic atom X-ray spectroscopy

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Exotic atoms allow studies in the fields of particle and nuclear physics as well as atomic and molecular phenomena. Inherent to exotic-atom research is a low count rate in the presence of demanding background conditions. Therefore, facilities providing high muon, pion and antiproton fluxes are mandatory in particular for ultimate resolution spectroscopy when using crystal spectrometers. Such high fluxes for pions and muons are available at the PSI pion factory with continuously increasing intensity and for antiprotons up to the year 1996 at the LEAR facility at CERN. Of special interest in the case of hadrons are the elementary systems formed with hydrogen where the strong-interaction effects give access to important threshold parameters, the scattering lengths and volumes. The performance crystal spectrometers allows the determination of the mass of the charged pion at the ppm level. In addition, Doppler broadening caused by collisional and molecular effects becomes directly detectable giving insight in exotic-atom formation and de-excitation.

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