

Laser spectroscopy of long-lived pionic helium at PSI

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The PiHe collaboration recently used the 590 MeV ring cyclotron facility of Paul Scherrer Institute to carry out laser spectroscopy of metastable pionic helium atoms [1,2]. This is a three-body atom consisting of a helium nucleus, a ground-state electron, and a negatively-charged pion occupying a Rydberg state of principal and orbital angular momentum quantum numbers of around $n=17$ and $l=16$. By using a sub-nanosecond infrared pulsed laser, the pion was resonantly deexcited from the state (17,16) to a short-lived state (17,15). In future experiments, we intend to increase the experimental precision and compare the results with three-body QED calculations. This would allow the negatively-charged pion mass to be determined with a higher precision than before.

[1] Nature 581, 37 (2020)

[2] Physical Review A 89, 042515 (2014)

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