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NEWS | MARCH 15 2019

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Scilight 2019, 110003 (2019)
https://doi.org/10.1063/1.5095774

AIP Publishing

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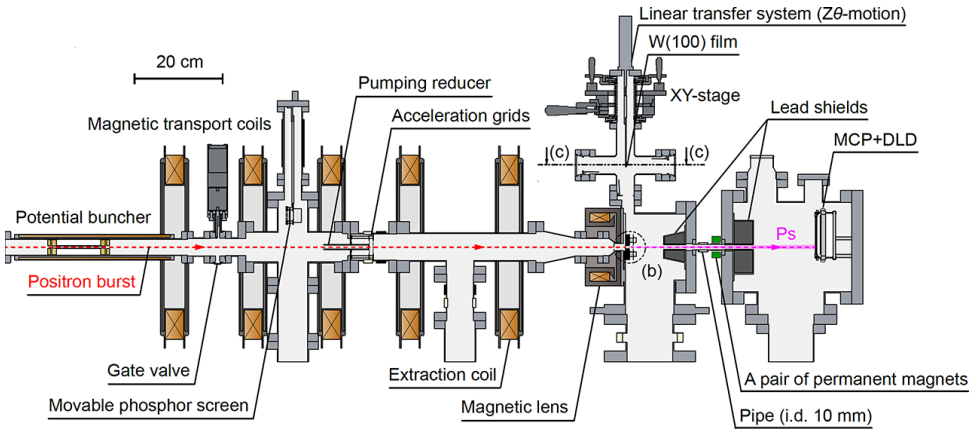
New paper introduces a new apparatus that can tune a high-quality, mono-energetic beam of positronium atoms to the desired energy.



Positronium atoms are quite unique. Their neutral nature hinders attempts to accelerate them into a workable beam. A team of scientists from Japan developed a device to produce a high quality, mono-energetic beam of positronium atoms that can be tuned to a desired energy.

“What is most exciting is that we finally produced a lab-based, high-quality beam of exotic atoms that no one had ever realized before simply by combining a set of novel technologies,” said Koji Michishio, a researcher at the National Institute of Advanced Industrial Science and Technology in Tsukuba, Japan and first author on the paper. “Anti-matter studies will now become easier and more accessible.”

The new paper introduces the device that is capable of accelerating a beam of positronium negative ions to the desired kinetic energy with an electric field. The team then performed photodetachment on the beam using an infrared laser.

This experimental configuration produced beams with higher energy and better quality than previous designs. The research team believes this new approach will open up new ways of experimentation to investigate novel materials and their properties.

Currently, the incident energies that can be investigated are limited to the intermediate energy range (0.2 – 3.3 keV) of the beam. While the upper limit of the energy range is determined by the voltage of the power supply and the insulating material, the lower limit of the energy range may be extended in the future by further reducing the flightpath length of the Ps negative ions up to photodetachment.

Source: “A high-quality and energy-tunable positronium beam system employing a trap-based positron beam,” by K. Michishio, L. Chiari, F. Tanaka, N. Oshima, and Y. Nagashima, *Review of Scientific Instruments* (2019). The article can be accessed at https://doi.org/10.1063/1.5060619.