

Dense positronium formation for Bose-Einstein condensation

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Positronium Bose-Einstein condensation (Ps-BEC) is one of the candidates for the first BEC containing antimatter. Ps-BEC is an interesting system to study macroscopic quantum effect of antimatter. It also has interesting applications such as antimatter gravity measurement and realization of 511-keV gamma-ray laser. Our target density of Ps-BEC transition is 10^{18} cm^{-3} at a temperature of 10 K [1]. The challenge is to create such dense and cold Ps within the short Ps lifetime of 142 ns. There are two element technologies: (i) instant production of dense Ps by bombarding high-density positron beam (Fig. 1) on porous material, (ii) rapid Ps cooling by a combination of thermalization and laser cooling. I will present recent experimental progress on dense Ps formation for Ps-BEC.

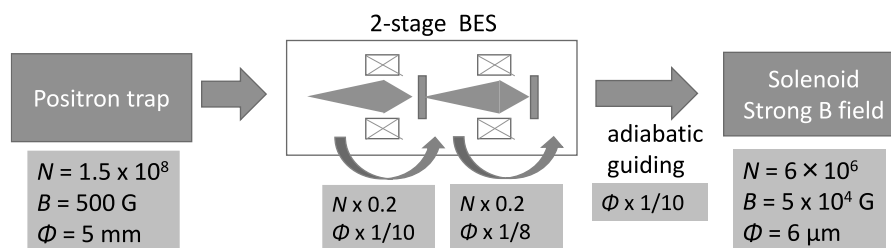


Fig.1. Conceptual diagram of our method to achieve dense enough positron bunch for Ps-BEC. Positrons extracted from the positron trap are magnetically focused by 2-stage brightness enhancement system (BES), and then adiabatically guided to the strong magnetic field for the final focusing. (A. Ishida, JWPS 2019, N. Oshima, ICPA-18)

Acknowledgement: This work was partially supported by JSPS KAKENHI Grant Numbers JP16H04526, JP17H02820, JP17H06205, JP17J03691, JP18H03855, JP19H01923, MATSUO FOUNDATION, Mitutoyo Association for Science and Technology (MAST), Research Foundation for Opto-Science and Technology, The Mitsubishi Foundation, TIA Kakehashi TK17-046 and TK19-016.

[1] A. Ishida *et al.*, *JJAP Conf. Proc.* **7**, 011001 (2018).