

Observation of quantum interference effect of positronium wave functions using single-layer graphene

Riki Mikami^{*}, Yugo Nagata and Yasuyuki Nagashima

*Department of Physics, Tokyo University of Science,
1-3 Kagurazaka, Shinjuku, Tokyo 162-8601, Japan*

^{*}email: 1220545@ed.tus.ac.jp

The quantum interference effect of electron and positron wave functions has been studied for many years. The effects of neutral atoms [1, 2] and molecules [3] have also been demonstrated. However, positronium interference has not been observed.

Recently, an energy-tunable positronium beam was developed [4]. We are conducting an experiment to observe the positronium diffraction spots using this beam and single-layer graphene.

Before acquiring the diffraction data, we studied the condition for clearly observing the diffraction spots through the graphene using electron diffraction. As a result, it was found that the diffraction spots became clear after laser heating the graphene [5].

We are now acquiring data by injecting the positronium beam into the graphene cleaned by the laser heating. From the data obtained by integrating the two-dimensional profile in the angular direction, a peak is seen at a position corresponding to diffraction peak. We will acquire more data with the aim of observing clear diffraction spots.

- [1] A. Schuller et al., Phys. Rev. Lett. **98**, 016103 (2007).
- [2] P. Rousseau et al., Phys. Rev. Lett. **98**, 016104 (2007).
- [3] M. Arndt et al., Nature **401**, 680-682 (1999).
- [4] K. Michishio et al., Rev. Sci. Instrum. **90**, 023305 (2019).
- [5] A. Niggas et al., J. Chem. Phys. **153**, 014702 (2020).