

# 凝縮系物理学ゼミナール

## Condensed Matter Seminar

Date: 13:30-15:00, Wednesday, 11 October 2023

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Title: Magnetism and superconductivity in mixed-dimensional periodic Anderson model for UTe<sub>2</sub>

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### Abstract:

Spin-triplet superconductor is very rare, and the elucidation of the mechanism has long been important. Spin-triplet superconductivity is a strong candidate for topological superconductivity and is considered to be very important from the viewpoint of applications.

UTe<sub>2</sub> is a candidate for a spin-triplet superconductor because of its extremely large upper critical field[1] and the result of NMR Knight shift[2] etc. UTe<sub>2</sub> does not exhibit ferromagnetic order, which is one of the features that distinguish it from other U-based ferromagnetic superconductors. The relationship between magnetism and superconductivity is considered to be important in UTe<sub>2</sub>, and superconductivity due to spin and charge fluctuations has been proposed[3]. This previous study has succeeded in explaining the ferromagnetic fluctuations and p-wave superconductivity in UTe<sub>2</sub>. However, the wave vector of antiferromagnetic fluctuations does not match the result of neutron scattering experiments[4], and a theory that explains the various phenomena has not yet emerged.

In this study, we apply the mixed-dimensional periodic Anderson model to UTe<sub>2</sub> to calculate magnetic fluctuations and superconducting instabilities. We investigate conditions that reproduce the experimental results of neutron scattering for magnetic fluctuations. We also discuss how the magnetic fluctuation and superconducting symmetry change with the nature of the Fermi surface.

### Reference :

- [1] Georg Knebel *et al.*, J. Phys. Soc. Jpn. **88**, 063707 (2019).
- [2] Hiroki Matsumura *et al.*, J. Phys. Soc. Jpn. **92**, 063701 (2023).
- [3] Jun Ishizuka and Youichi Yanase, Phys. Rev. B **103**, L094504 (2021).
- [4] Wiliam Knafo *et al.*, Phys. Rev. B **104**, L100409 (2021).