

凝縮系物理学ゼミナール

Condensed Matter Seminar

Location: **Room 115**, School of Science Bldg. 5 (理学 5 号館 115 号室)

Date: **13:30-15:00**, Tuesday, 12 November 2019

“Superconductivity induced by fluctuations of momentum-based multipoles”

Speaker:

Shuntaro Sumita (Condensed Matter Theory Group)

Abstract:

Recent studies of superconductivity have focused on spin fluctuation, instead of electron-phonon coupling, as an origin of attractive interaction between electrons. Such superconductivity mediated by fluctuations of electric or magnetic orders is a central issue in this field.

On the other hand, a multipole order, which represents electrons' degrees of freedom in strongly spin-orbit coupled systems, is attracting much attention. Therefore, it is helpful for understanding unconventional superconductivity to consider “superconductivity induced by fluctuations of multipole orders,” as an extension of spin-fluctuation-mediated superconductivity. Indeed, previous works have studied superconductivity induced by fluctuations of *odd-parity electric* multipole orders [1, 2]. Especially, Ref. [1] suggested that odd-parity (spin-triplet) superconductivity is realized by a ferroic fluctuation of odd-parity electric multipoles, using the multipole classification in *isotropic* systems [3].

Stimulated by the above backgrounds, we study superconductivity induced by fluctuations *odd-parity magnetic* multipoles, aiming at good understanding of multipole-fluctuation-mediated superconductivity. Furthermore, this study focuses on the effect of *crystalline electric fields* using the classification theory of multipoles [4, 5], while the previous studies [1, 3] simply assume isotropic systems. As a result, we suggest that a nodal extended *s*-wave pairing may be favored by an odd-parity magnetic multipole fluctuation under crystalline electric fields.

References:

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- [2] J. M. Edge, Y. Kedem, U. Aschauer, N. A. Spaldin, and A. V. Balatsky, Phys. Rev. Lett. **115**, 247002 (2015).
- [3] L. Fu, Phys. Rev. Lett. **115**, 026401 (2015).
- [4] H. Watanabe and Y. Yanase, Phys. Rev. B **98**, 245129 (2018).
- [5] S. Hayami, M. Yatsushiro, Y. Yanagi, and H. Kusunose, Phys. Rev. B **98**, 165110 (2018).