

凝縮系物理学ゼミナール

Condensed Matter Seminar

Location: Online (zoom seminar)

Date: **13:30-15:00**, Wednesday, 2nd December 2020

“Nonequilibrium quantum phenomena and topological superconductivity in atomic layer materials”

Speaker:

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Abstract:

Thanks to the recent breakthrough in THz wave and intensive short-pulse laser techniques, novel physical phenomena that are difficult to be stabilized in an equilibrium state have been vigorously studied both theoretically and experimentally. These studies play a key role in controlling topological phases in solid-states of matter. As pioneering studies, quantum anomalous Hall state was theoretically proposed in graphene [1], and the observation of this phenomenon was reported last year [2]. The optical control techniques are also useful for designing topological superconductivity (TSC). For example, topological *d*-wave superconductivity induced with laser light was theoretically proposed in cuprate thin films [3].

On the other hand, the recent progress of nanotechnology and atomic layer materials research has created an experimental environment for two-dimensional superconductivity with atomically thin materials. As one of the methods to do, the electric double-layer transistor (EDLT) technique enables us to realize clean superconductivity phases in the atomic layer materials such as transition metal dichalcogenides (TMD) [4] and ZrNCl.

In our work, we proposed a way to realize topological *s*-wave superconductivity with the application of circularly polarized laser light in the transition metal dichalcogenides bilayer [5].

References:

- [1] T. Oka and H. Aoki, Phys. Rev. B **79**, 081406 (2009).
- [2] J. W. McIver, B. Schulte, F.-U. Stein, T. Matsuyama, G. Jotzu, G. Meier, and A. Cavalleri, Nat. Phys. **16**, 38 (2020).
- [3] K. Takasan, A. Daido, N. Kawakami, and Y. Yanase, Phys. Rev. B **95**, 134508 (2017).
- [4] J. Ye, Y. Zhang, R. Akashi, M. Bahramy, R. Arita, and Y. Iwasa, Science **338**, 1193 (2012).
- [5] **HC**, K. Takasan, and Y. Yanase, Phys. Rev. B **102**, 174508 (2020).