先端光量子科学アライアンス談話会

光量子科学研究センターセミナー

フォトンサイエンス研究機構セミナー

# “Theoretical Study of Laser Control of Magnetization and Chirality in Quantum Magnets and Multiferroics”


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場　所　：　東京大学理学部1号館2階233号室


## Abstract

Periodically-driven quantum systems are attracting huge interest recently [1-6]. This is mainly due to the rapid development in laser physics. Strong lasers with well controlled phase can be prepared to realize driven quantum states. From the theory side, powerful techniques such as the Floquet theory are being applied with which we can map such nonequilibrium systems to effective *static* systems enabling us to apply various theoretical concepts from stationary physics.

We focus on laser-driven dynamics in quantum antiferromagnets [4,6] and multiferroics [5], which are known to exhibit many exotic quantum many-body effects. We found three novel laser-induced nonequilibrium phenomena in these systems [4,5,6]: (i) When we apply a circularly polarized laser to quantum magnets with gradually increasing the laser frequency (i.e., chirping), the magnetization can follows the equilibrium magnetization curve as a function of time [4]. (ii) When we apply an elliptically (or circularly) polarized laser to multiferroic systems with a magnetoelectric coupling between electric polarization and spin chirality, a new synthetic Dzyaloshinskii-Moriya (DM) interaction emerges [5]. (iii) When we apply an elliptically (or circularly) polarized laser to the Kitaev honeycomb-lattice model with a magneto-striction type coupling, a topological gapped spin-liquid state with a gapless chiral edge mode appears [6]. In the seminar, I will mainly discuss (i) and (ii) which are expected to immediately become relevant in near-future experiments and offer novel ways to control magnetization and DM interactions by using laser.


（The talk will be given in Japanese. 講演は日本語で行われます。）

**References**


[1]T. Oka and H. Aoki, Phys. Rev. B **79**, 081406(R) (2009).
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[3] Y. H. Wang, H. Steinberg, P. Jarillo-Herrero, and N. Gedik, Science **342**, 453 (2013).
[4] S. Takayoshi, M. Sato, and T. Oka, arXiv1402.0881.
[5] M. Sato, S. Takayoshi, and T. Oka, in preparation.
[6] M. Sato, and Y. Sasaki, and T. Oka, arXiv:1404.2010.


紹介教員：岡隆史講師　(物理工学専攻)