凝縮系物理学ゼミナール
Condensed Matter Seminar

Date: 13:30-15:00, Wednesday, 29 November 2023

Title: Nonlinear Electric-field-induced Spin Polarization in Strongly Correlated Electron Systems

Speaker: Mr. Jun Oike (Condensed Matter Theory Group)

Abstract:

A central issue in modern spintronics is the electrical generation and control of spin. One of means achieving this is spin polarization which leads to spin accumulation by an applied electric field. Although spin polarization is usually treated within a linear approximation to the electric field, recently, nonlinear spin polarization, which incorporates even nonlinear effects, has been formulated [1][2] and one expect to create novel spintronics phenomena using nonlinear effects.

On the other hand, electron correlations are often overlooked due to the complexity caused by nonlinear effects. In recent years, however, large nonlinear conductivities have been observed in strongly correlated electron systems [3][4], indicating that many body effects play an essential role in nonlinear responses. Therefore, while strongly correlated electron systems are one of the most promising candidates for pioneering spintronics including nonlinear effects, no studies have considered strong correlation effects in nonlinear responses involving spin directly.

Here, we have analyzed nonlinear spin polarization driven by the incident electric field with the aim of clarifying the influence of electron correlations. The driving electric field can be divided into DC current and light. In the latter case, we find that the behavior of the response to the interaction depends on the polarization of light. In this talk, I will show the results of the calculations in detail and discuss the physical origin which gives rise to such difference.

Reference :

[1]. C. Xiao, et al., Phys. Rev. Lett. **129**, 086602 (2022).
[2]. C. Xiao, et al., Phys. Rev. Lett. **130**, 166302 (2023).
[3]. H. Kishida, et al., Nature **405**, 929-932 (2000).
[4]. S. Dzsaber, et al., PNAS. **118**, e2013386118 (2021).