



筑波大学

*University of Tsukuba*

## Condensed Matter Seminar

### 物性論セミナー

2025年3月25日 (火), Mar 25 (Tue), 2025, 15:00-16:00

自然系学系棟D棟3階: 301号室 (Institutes of Natural Sciences Bldg. D 301)

[\[Map\]](#)

## **Orbital magnetic susceptibility in metals and insulators: role of band structure and quantum geometry**

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Upon approaching a magnet, any nonmagnetic material feels a force. This force finds its origin in the spin and charge (orbital) motions of the electrons of the materials under the influence of the magnet field. For most materials this force is attractive because it is dominated by the spin magnetic susceptibility which is always paramagnetic. When the force appears repulsive the material is said to be diamagnetic and its magnetic response is then determined by the orbital motion of electrons. A well known example of diamagnetic material is water. In this talk I will review the microscopic theory of "diamagnetism" encoded by the orbital magnetic susceptibility of electrons in metals and insulators. First, I will remind why orbital magnetism is a genuine quantum effect related to the quantum motion of a charge in magnetic field. I will then show how the early theory of Landau and Peierls succeeds in describing the orbital response of single band metals but fail in describing multiband systems. Then I will present our work highlighting the key role of interband effects encoded in the quantum geometry of Bloch states (Berry curvature and quantum metric) in order to correctly describe the orbital magnetic susceptibility of multiband systems metal and insulators.

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