



# 第 104 回トポロジカル物質科学セミナー Topological Materials Science Seminar (104)

## Topological Electrides

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**Date: Aug. 21 (Wed), 2019**

**Time: 16:00-17:15**

### Abstract:

Research on the topological properties of the wave function attracts a great deal of attention [1]. In our presentation, we show that electrides are suitable for achieving various topological insulating and topological semimetal phases [2]. In electrides, some electrons reside in the interstitial regions and act as anions to stabilize the structure. Since interstitial electrons have small work function, band inversion around the Fermi level is likely to occur. We find that  $\text{Sc}_2\text{C}$  shows nontrivial insulating phase characterized by the  $\pi$  Zak phase. This  $\pi$  Zak phase appears as a surface polarization charge, and we propose that this surface charge is useful for carrier doping by using the electride. We find various topological electrides such as  $\text{Y}_2\text{C}$ ,  $\text{Sr}_2\text{Bi}$  (nodal-line semimetal),  $\text{HfBr}$  (quantum spin Hall system), and  $\text{LaBr}$  (quantum anomalous Hall insulator). We also discuss one-dimensional electride materials, apatite, as higher-order topological crystalline insulator with quantized corner charges [3]. In the apatite electride, since anion electrons exist in a one-dimensional region, it is expected that a topological quantized charge appears at the hinge.

### References:

- [1] M.Hirayama, R. Okugawa, and S. Murakami, J. Phys. Soc. Jpn. 87, 041002 (2018).  
(Review)
- [2] M.Hirayama, S. Matsuishi, H. Hosono, and S. Murakami, Phys. Rev. X 8, 031067 (2018).
- [3] M.Hirayama, R. Takahashi, S. Matsuishi, H. Hosono, and S. Murakami, in preparation.