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Non-reciprocal/Non-linear charge and spin current in non-centrosymmetric spin-orbit coupled systems

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Abstract:

It is expected that the unidirectionality appears in non-centrosymmetric systems. The most outstanding example is the directional dichroism of the light where the transmittance depends on the direction of the light.

In this seminar, I will report our recent study on non-reciprocal/non-linear charge transport in Rashba system, where electrical resistivity depends on the direction of the current like a diode. We developed a non-linear transport theory simply by solving the Boltzmann equation and clarified the origin of the non-reciprocity. We also found that non-reciprocal signal is determined only by intrinsic band parameters, which may offer a new electrical probe for the band structure in Rashba systems.

Non-linear theory developed here can be easily applied also to the spin current. We have proposed that the spin current second order in the applied electric field appears in non-centrosymmetric spin-orbit coupled systems such as Rashba-Dresselhaus system and the surface state of the three-dimensional topological insulator. We also propose a unified way of understanding of non-linear charge/spin current in terms of the field induced distortion of the Fermi surface and the non-trivial spin texture on it.

References

- [1] T. Ideue, K. H., S. Koshikawa, et. al., (accepted in Nat. Phys.)
- [2] K. H., M. Ezawa, K. W. Kim, T. Morimoto, N. Nagaosa, submitted