

1 Aoki Group

Subject: Theoretical condensed-matter physics

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Our main interests are many-body and topological effects in electron systems, i.e., **superconductivity, magnetism and topological phenomena**, for which we envisage a **materials design for correlated electron systems** and novel **non-equilibrium** phenomena should be realised. Studies in the 2012 academic year include:

- **Superconductivity**[1]
 - High-Tc cuprates: material- and pressure-dependence [2]
 - Multi-layer high-Tc cuprates [3]
 - Organic and carbon-based superconductors [4,5]
 - Superconductivity induced in non-equilibrium:
 - Dynamical repulsion-attraction conversion in intense ac fields [6]
- **Topological systems**
 - Spin Hall effect in the iron-based superconductors [7]
 - Graphene quantum Hall system and the chiral symmetry[8-10]
 - Optica (THz) quantum Hall effect in the 2D electron gas and in graphene [11]
 - Graphene quantum dot [12]
 - Fractional quantum Hall effect in oxides [13]
 - Zeolite-templated carbon [14]
- **Non-equilibrium phenomena**
 - Dielectric breakdown of Mott insulators[15]
 - Dynamical phase transitions in correlated electron systems
 - Dicke transition in solids placed in an optical cavity
 - Nonequilibrium quantum spin systems[16]

[1] Hideo Aoki, *J. Superconductivity and Novel Magnetism* **25**, 1243 (2012).

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[3] K. Nishiguchi, K. Kazuhiko, R. Arita, T. Oka, and H. Aoki, arXiv:1212.6320.

[4] Takashi Kambe *et al*, *Phys. Rev. B* **86**, 214507 (2012) (Editors' Suggestion).

[5] Q. Xin *et al*, *Phys. Rev. Lett.* **108**, 226401 (2012).

[6] N. Tsuji, T. Oka, H. Aoki and P. Werner, *Phys. Rev. B* **85**, 155124 (2012).

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[11] R. Shimano, G. Yumoto, J. Y. Yoo, R. Matsunaga, S. Tanabe, H. Hibino, T. Morimoto and H. Aoki, *Nature Commun.*, to be published.

[12] P.A. Maksym and H. Aoki, arXiv:1211.5552.

[13] D. Maryenko, J. Falson, Y. Kozuka, A. Tsukazaki, M. Onoda, H. Aoki and M. Kawasaki, *Phys. Rev. Lett.* **108**, 186803 (2012).

[14] Takashi Koretsune, Ryotaro Arita and Hideo Aoki, *Phys. Rev. B* **86**, 125207 (2012).

[15] Takashi Oka, *Phys. Rev. B* **86**, 075148 (2012).

[16] Shintaro Takayoshi, Hideo Aoki and Takashi Oka, in quantum magnets, arXiv:1302.4460.