1 Ogata Group

Research Subjects: Condensed Matter Theory

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We are studying condensed matter physics and many body problems, such as strongly correlated electron systems, high-T_c superconductivity, Mott metal-insulator transition, magnetic systems, low-dimensional electron systems, organic conductors, unconventional superconductivity, and Dirac electron systems in solids. The followings are the current topics in our group.

- High-T_c superconductivity
  High-T_c superconductivity as a doped Mott insulator studied in the Hubbard model.[1]
  Flux states in high-T_c superconductivity.
- Organic conductors
  Thermoelectric transport coefficients for massless Dirac electrons in organic compounds.[2]
  Effect of tilting on the in-plane conductivity of Dirac electrons in organic compounds.[3]
  Spin liquid states realized in organic compounds and spin systems.
  Zero-energy localized state induced by impurity in Dirac electron system of organic conductor.[4]
- Dirac electron systems in solids [5]
  Spin-Hall effects and large diamagnetism in Dirac fermion systems.[6]
  Electronic states in a new Dirac system: Ca_3PbO and related materials.[7]
- Theories on heavy fermion systems and multi-band electron systems
  Charge Kondo effect due to pair-hopping mechanism.
  Spin triplet superconductivity in UPt_3
  Theory of Ru oxides: heavy fermion behavior and spin fluctuations.[8]
- Chiral magnets and spin-orbit interaction
  Effective model and Dzyloshinskii-Moriya interaction for chiral magnet, $CrNb_3S_6$.[9]
  Spin-orbit interaction in $4d^3$ and $5d^3$ electron systems.[10]
  Superexchange interactions from the j-j coupling.[11]

[1] H. Yokoyama, M. Ogata, Y. Tanaka, K. Kobayashi, and H. Tsuchiura: J. Phys. Soc. Jpn. **82**, 014707-1-16 (2013). "Crossover between BCS Superconductor and Doped Mott Insulator of d-wave Pairing State in Two-Dimensional Hubbard Model"

[2] I. Proskurin, and M. Ogata: J. Phys. Soc. Jpn. **82**, 063712-1-4 (2013). "Thermoelectric Transport Coefficients for Massless Dirac Electrons in Quantum Limit"

[3] Y. Suzumura, I. Proskurin, and M. Ogata: J. Phys. Soc. Jpn. **83**, 023701-1-4 (2014). "Effect of Tilting on the In-Plane Conductivity of Dirac Electrons in Organic Conductor"

[4] T. Kanao, H. Matsuura, and M. Ogata: in preparation. "Defect-induced zero-energy localized state in massless Dirac electron system α-$(ET)_2I_3$"

[5] Y. Fuseya, M. Ogata, and H. Fukuyama: Review article in preparation. "Transport Phenomena and Diamagnetism of Dirac Electrons in Bismuth"

[6] Y. Fuseya, M. Ogata, and H. Fukuyama: submitted to J. Phys. Soc. Jpn.. "Spin-Hall Effect and Diamagnetism of Anitostopic Dirac Electrons in Solids"

[7] T. Kariyado and M. Ogata: in preparation. "Twin Dirac electrons and diamagnetism in Ba_3SnO"

[8] N. Arakawa and M. Ogata: Phys. Rev. B **87**, 195110-1-11 (2013). "Competition between spin fluctuations in $Ca_{2-x}Sr_xRuO_4$ around $x = 0.5$"

[9] H. Matsuura, T. Shishidou, and M. Kishine: in preparation. "Derivation of Dzyloshinskii-Moriya Interaction on Metallic Chiral Magnet $CrNb_3S_6$"

[10] H. Matsuura and K. Miyake: J. Phys. Soc. Jpn. **82**, 063709-1-4 (2013). "Effect of Spin-Orbit Interaction on $(4d)^3$- and $(5d)^3$-Based Oxides"

[11] H. Matsuura, and M. Ogata: in preparation. "Superexchange Mechansim Based on J-J Coupling Scheme "