As of March 2018

Department of Physics

Research Area : Quantum Structural Physics in Correlated Matter

(URL : http://www.physics.okayama-u.ac.jp/nogami_homepage/n/)

Yoshio NOGAMI, Professor
Ryusuke KONDO, Associate Professor

Research Themes :

》 Competition among Magnetism and CDW in $RNiC_2$ without the inversion symmetry.
》 Anomalous phase neighboring the CO Phase in Organics.
》 Development of Novel Material with the Variation of Spin-Orbit Coupling.

Representative Publication :

• N.Hanasaki, S.Shimomura, M.Mikami, Y.Nogami, H.Nakao, and H.Onodera, Interplay between charge-density wave and antiferromagnetic order in $GdNiC_2$, Phys. Rev. B 95, 085103 (2017).
• H. Matsuzaki, M. Ohkura, Yu Ishige, Y. Nogami and H. Okamoto, Photoinduced switching to metallic states in the two-dimensional organic Mott insulator dimethylphenazine-tetrafluorotetracyanoquinodimethane with anisotropic molecular stacks, Phys. Rev. B 91, 245140 (2015).
• N. Yamamoto, R. Kondo, H. Maeda, and Y. Nogami: Interplay of Charge-Density Wave and Magnetic Order in Ternary Rare-Earth Nickel Carbides, $RNiC_2$ (R=Pr and Nd), J. Phys. Soc. Jpn. 82, 123701 (2013).

Research Area : Quantum Physics in Correlated Matter

(URL: http://www.physics.okayama-u.ac.jp/mino/index_e.html)

Michinobu MINO, Professor

Research Themes:

》 Spatiotemporal Chaos and Nonequilibrium Pattern Formation in a Magnetic Material.
》 Spin-Wave Relaxation.

Representative Publication :

• M. Mino and Y. Yamamoto, Chaotic Motion of a Magnetic Domain Structure under an Alternating Field, *J. Kor. Phys. Soc.*, pp. 605-607 (2013).
• M. Mino, M. Tsukamoto, K. Fujikawa and Y. Ono, Microwave radiation from parametrically excited YIG,*J. Magn. Magn. Mater*. **310**, pp. e549-e551(2007).

Research Area : Physics in Advanced functional materials

(URL: https://ikedalaboratory.wordpress.com)
(URL: http://www.physics.okayama-u.ac.jp/nogami_homepage/k/)

Naoshi IKEDA, Professor
Takashi KAMBE, Associate Professor
Yasushi MATSUSHIMA, Senior Assistant Professor

Research Themes:

》 Condensed Matter Physics in which Non-trivial Quantum Parameter Appears
》 Novel Ferroelectricity
》 Novel Organic Superconductors and Magnets
》 Organic Electronic Devises
》 Study of Mechanically-alloyed Magnetic Powders

Representative Publication :

- T. Kambe, Y. Fukada, J. Kano, T. Nagata, H. Okazaki, T. Yokoya, S. Wakimoto, K. Kakurai, N. Ikeda, Magnetoelectric Effect Driven by Magnetic Domain Modification in $LuFe_2O_4$, *Phys. Rev. Lett*. **110**, 117602 (2013).
- K. Yoshii, N. Ikeda, Y. Nishihata, D. Maeda, R. Fukuyama, T. Nagata, J. Kano, T. Kambe, Y. Horibe, S. Mori, Exchange Bias in Multiferroic RFe_2O_4 (R = Y, Er, Tm, Yb, Lu, and In), *J. Phys. Soc. Jpn*. **81**, 033704 (2012).
- T. Kambe, X. He, Y. Takahashi, Y. Yamanari, K. Teranishi, H. Mitamura, S. Shibasaki, K. Tomita, R. Eguchi, H. Goto, Y. Takabayashi,T. Kato, A. Fujiwara, T. Kariyado, H. Aoki, Y. Kubozono, Synthesis and physical properties of metal-doped picene solids, *Phys. Rev*. B, **86**, 214507 (2012) [Selected as editors' suggestion].

Research Area : Materials Physics in Extreme Environments

(URL: http://www.physics.okayama-u.ac.jp/kobayashi_homepage/index-en.html)

Tatsuo C. KOBAYASHI, Professor
Yoshihiko INADA, Professor
Shingo ARAKI, Associate Professor
Kazuto AKIBA, Assistant Professor

Research Themes:

》 Pressure-induced Quantum Phase Transitions in Strongly Correlated Electron Systems

》 Field-induced Phase Transition in Condensed Molecular Oxygen

》 Exotic Phases under High Pressure in Simple Systems

Representative Publication :

- T. Nomura, Y. H. Matsuda, J. L. Her, S. Takeyama, A. Matsuo, K. Kindo, T. C. Kobayashi, Novel phase of solid oxygen induced by ultrahigh magnetic fields, Phys. Rev. Lett. **112**, 247201 (2014).
- T. C. Kobayashi, K. Fujiwara, K. Takeda, H. Harima, Y. Ikeda, T. Adachi, Y. Ohishi, C. Geibel, F. Steglich, Valence crossover of Ce ions in $CeCu_2Si_2$ under high pressure —Pressure dependence of the unit cell volume and the NQR Frequency—, J. Phys. Soc. Jpn. **82**, 114701 (2013).
- S. Araki, M. Hayashida, N. Nishiumi, H. Manabe, Y. Ikeda, T. C. Kobayashi, K. Murata, Y. Inada, P. Wisniewski, D. Aoki, Y. Onuki, E. Yamamoto, Y. Haga, Pressure-temperature-field phase diagram in a ferromagnet U_3P_4, J. Phys. Soc. Jpn. **84**, 024705 (2015).

Research Area : Low Temperature Condensed Matter Physics

(URL: http://www.physics.okayama-u.ac.jp/zheng_homepage/)

Guo-qing ZHENG, Professor
Shinji KAWASAKI, Associate Professor
Kazuaki MATANO, Assistant Professor

Research Themes:

》 Synthesis and NMR/NQR Study of Topological Superconductors and Semimetals

》 NMR/NQR Study on Noncentrosymmetric Superconductors

》 NMR/NQR Study on Heavy Fermion Superconductivity at High Pressure and Low Temperature

》 NMR study of High-T_c superconductivity in copper oxides at very high magnetic fields.

》 NMR/NQR Study of Magnetism and Superconductivity in Iron-pnictide Superconductors

Representative Publication :

- S. Kawasaki, Z. Li, M. Kitahashi, C. T. Lin, P. L. Kuhns, A. P. Reyes, and Guo-qing Zheng, Charge-density-wave order takes over antiferromagnetism in $Bi_2Sr_{2-x}La_xCuO_6$ superconductors, Nature Communications **8**, 1267 (2017).
- Spin-rotation symmetry breaking in the superconducting state of $Cu_xBi_2Se_3$, K. Matano, M. Kriener, K. Segawa, Y. Ando, Guo-qing Zheng, Nature Physics **12**, 852 (2016).
- S. Kawasaki, T. Mabuchi, S. Maeda, T. Adachi, T. Mizukami, K. Kudo, M. Nohara, and G.-q. Zheng, Doping-enhanced antiferromagnetism in $Ca_{1-x}La_xFeAs_2$, Phys. Rev. B **92**, 180508(R) (2015).

Research Area : Quantum Physics in Condensed Matter

(URL: http://www.physics.okayama-u.ac.jp/nohara_homepage/index_e.html)

Minoru NOHARA, Professor
Kazutaka KUDO, Associate Professor
Sin-ya AYUKAWA, Assistant Professor

Research Themes:

》 Exotic Superconductors with High Transition Temperature

》 High-performance Thermoelectric Materials

Representative Publication :

- M. Nohara and K. Kudo, *Arsenic chemistry of iron-based superconductors and strategy for novel superconducting materials*, Advances in Physics: X **2**, 450 (2017).
- K. Kudo, H. Ishii, and M. Nohara, *Composition-induced structural instability and strong coupling superconductivity in* $Au_{1-x}Pd_xTe_2$, Phys. Rev. B **93**, 140505(R) (2016).
- K. Kudo, Y. Kitahama, K. Fujimura, T. Mizukami, H. Ota, and M. Nohara, *Superconducting transition temperatures of up to 47 K from simultaneous rare-earth element and antimony doping of 112-type* $CaFeAs_2$, J. Phys. Soc. Jpn. **83**, 093705 (2014).

Research Area : Physics of Solid Surfaces and Interfaces

(URL: http://film.rlss.okayama-u.ac.jp/index_eng.html)
(URL:http://www.okayama-u.ac.jp/user/akimitsu/top_eng.html)

Takayoshi YOKOYA, Professor
Yuji MURAOKA, Associate Professor
Kaya KOBAYASHI, Associate Professor

Research Themes:

》 Photoemission Study of Electronic Structure of Functional Materials

》 Spinodal Decomposition in Oxide Thin Films

》 New Superconductor in Diamond Related Films

》 Novel superconductors

》 Layered superconductors

Representative Publication :

- K. Terashima, M. Sunagawa, H. Fujiwara, T. Fukura, M. Fujii, K. Okada, K. Horigane, K. Kobayashi, R. Horie, J. Akimitsu, E. Golias, D. Marchenko, A. Varykhalov, N. L. Saini, T. Wakita, Y. Muraoka, and T. Yokoya, Evolution of the remnant Fermi-surface state in the lightly doped correlated spin-orbit insulator $Sr_{2-x}La_xIrO_4$, *Phys. Rev. B* 96, 041106(R) (2017).
- M. Sunagawa, K. Terashima, T. Hamada, H. Fujiwara, T. Fukura, A. Takeda, M. Tanaka, H. Takeya, Y. Takano, M. Arita, K. Shimada, H. Namatame, M. Taniguchi, K. Suzuki, H. Usui, K. Kuroki, T. Wakita, Y. Muraoka, and T. Yokoya, Observation of a Hidden Hole-Like Band Approaching the Fermi Level in K-Doped Iron Selenide Superconductor, *J. Phys. Soc*. Jpn. 85, 073704 (2016).
- M. Ogata, K. Kadowaki, M. Ijiri, Y. Takemoto, K. Terashima, T. Wakita, T. Yokoya, and Y. Muraoka, Effect of aliovalent dopants on the kinetics of spinodal decomposition in rutile-type TiO_2-VO_2, *J. Eur. Ceram*. Soc. 37, 3177 (2017).
- K. Kobayashi, T. Ueno, H. Fujiwara, T. Yokoya, and J. Akimitsu, Unusual upper critical field behavior in Nb-doped bismuth selenides, *Phys. Rev. B* 95, 180503(R) (2017).
- T. Furukawa, Y. Shimokawa, K. Kobayashi, and T. Itou, Observation of current-induced bulk magnetization in elemental tellurium, *Nature Commun*. 8, 954 (2017).

Research Area : Condensed Matter Physics

(URL: http://www.physics.okayama-u.ac.jp/cmp/index_e.html)

Kozo OKADA, Professor
Yoshihiro NISHIYAMA, Assistant Professor

Research Themes:

》 Theoretical Studies on High-energy Spectroscopy for Highly-correlated Electron Systems

》 Phase Transition and Critical Phenomena

》 Mathematical Physics

Representative Publication :

- Y. Nishiyama, *Universal scaled Higgs-mass gap for the bilayer Heisenberg model in the ordered phase, Eur. Phys. J.* B **89**, 31 (2016).
- Y. Nishiyama, *Magnon-bound-state hierarchy for the two-dimensional transverse-field Ising model in the ordered phase*, Physica A **463**, 303-309 (2016).
- K. Okada and K. Takahashi, *Resonant Inelastic X-ray Scattering at the Ti K Absorption Edge of $SrTiO_3$*, J. Phys. Soc. Jpn. **85**, 044702 (2016).
- K. Okada and Y. Takeuchi, Nonlocal *Screening Effects on the Ni 2p Core Level Photoemission of the Linear-Chain Nickelate Y_2BaNiO_5*, J. Phys. Soc. Jpn. **86**, 064701 (2017).

Research Area : Quantum Many-Body Physics

(URL: http://www.physics.okayama-u.ac.jp/mp/index.eng.html)

(URL: http://www.physics.okayama-u.ac.jp/jeschke_homepage/research.html)

Masanori ICHIOKA, Professor
Harald O. JESCHKE, Professor
Seiichiro ONARI, Associate Professor
Hiroto ADACHI, Associate Professor
Nayuta TAKEMORI, Assistant Professor

Research Themes:

》 Theory of Vortex States in Superconductors
》 Theory of Electric-field-Induced Surface Superconductivity
》 First Principles Theory for Complex Magnets and Superconductors
》 Theory for Electronic and Magnetic Properties of Strongly Correlated Materials
》 Theory of Novel Spin Transport Phenomena

Representative Publication :

- M. Nabeta, K.K. Tanaka, S. Onari, and M. Ichioka, Pair breaking of multigap superconductivity under parallel magnetic fields in the electric-field-induced surface metallic state, Phys. Rev. B 96, 094522 (2017).
- H. C. Kandpal, I. Opahle, Y.-Z. Zhang, H. O. Jeschke, and R. Valenti, Revision of Model Parameters for κ-Type Charge Transfer Salts: An Ab Initio Study, Phys. Rev. Lett. 103, 067004 (2009).
- S. Onari, Y. Yamakawa, and H. Kontani, Sign-Reversing Orbital Polarization in the Nematic Phase of FeSe due to the C2 Symmetry Breaking in the Self-Energy, Phys. Rev. Lett. 116, 227001 (2016).
- M. Inoue, M. Ichioka, and H. Adachi, Spin pumping into superconductors: A new probe of spin dynamics in a superconducting thin film, Phys. Rev. B 96, 024414 (2017).
- N. Takemori and A. Koga, Local Electron Correlations in a Two-Dimensional Hubbard Model on the Penrose Lattice, J. Phys. Soc. Jpn. 84, 023701 (2015).

Research Area : Astroparticle Physics

(URL: http://www.physics.okayama-u.ac.jp/~ishino/index.html)

(URL: http://www.physics.okayama-u.ac.jp/~sakuda/index_e.html)

Hirokazu ISHINO, Professor
Makoto SAKUDA, Professor

Research Themes:

》 Astroparticle Physics using Neutrinos from Supernova Explosion
》 Cosmic Microwave Background
》 Dark Matter Search with Superconducting Detectors
》 Study of Neutrino-Nucleus Interactions

Representative Publication :

- K. Abe, H. Ishino, M. Sakuda et al., Real-time supernova neutrino burst monitor at Super-Kamiokande, Astropart. Phys. 81, 39-48 (2016).
- D. T. Hoang, G. Patanchon, M. Bucher, T. Matsumura, R. Banerji, H. Ishino, M. Hazumi, J. Delabrouille: Bandpass mismatch error for satellite CMB experiments I: estimating the spurious signal, J. Cosmology and Astropart. Phys. 12, 015 (2017).
- S. X. Nakamura, Y.Hayato, M.Hirai, W.Horiuchi, H.Kamano, S.Kumano, T.Murata, K.Saito, M.Sakuda, T.Sato, Towards a Unified Model for the Neutrino-Nucleus Reactions, Rep. Prog. Phys. 80, 056301, 1-38 (2017).
- A. Ankowski, O. Benhar and M. Sakuda, Improving the accuracy of neutrino energy reconstruction in charged-current quasielastic scattering off nuclear targets, Phys. Rev. D 91, 033005 (2015).

Research Area : Elementary Particle Physics

(URL: http://www.physics.okayama-u.ac.jp/koshio/index_e.html)

Yusuke KOSHIO, Associate Professor
Shintaro ITO, Research fellowship in JSPS

Research Themes:

》 Observation of Astro-Neutrinos (from core-collapse Supernovae, the Sun, etc.)

》 Neutrino physics at Accelerators

》 Search for Nucleon Decay

》 Study on Oxygen nucleus by proton and neutron beam

Representative Publication :

• K. Abe, Y.Koshio et al. (Super-Kamiokande Collaboration), Search for neutrinos in Super-Kamiokande associated with gravitational-wave events GW150914 and GW151226, The Astrophysical Journal Letters 830, L11 (6pp) (2016).
• K. Abe, Y. Koshio et al. (T2K Collaboration), Combined Analysis of Neutrino and Antineutrino Oscillations at T2K, Phys. Rev. Lett. 118, 151801 (2017).
• S. Ito et al., Determination of trace levels of uranium and thorium in high purity gadolinium sulfate using the ICP-MC with solid-phase chromatographic extraction resin, Prog. Theor. Exp. Phys. 2017, 113H01 (2017).

Research Area : Physics of Quantum Universe

(URL: http://www.xqw.okayama-u.ac.jp/en)

Koji YOSHIMURA , Professor
Satoshi UETAKE, Associate Professor
Akihiro YOSHIMI, Associate Professor

Research Themes:

》 Neutrino Mass Spectroscopy using Atoms and Molecules

》 Coherent nuclear photonics using ultra-low energy isomeric state of Thorium-229 nuclei

》 A new gamma-ray source using a quantum ion beam based on a novel principle.

Representative Publication :

• Nuclear resonant scattering experiment with fast time response: photonuclear excitation of ^{201}Hg, A. Yoshimi, H. Hara, T. Hiraki, T. Masuda, Y. Miyamoto, K. Okai, S. Okubo, R. Ozaki, N. Sasao, O. Sato, K. Suzuki, S. Uetake, K. Yoshimura, M. Yoshimura et al., Phys. Rev. C 97, 024607 (2018) [DOI: https://doi.org/10.1103/PhysRevC.97.024607].
• Fast x-ray detector system with simultaneous measurement of timing and energy for a single photon, T. Masuda, S. Okubo, H. Hara, T. Hiraki, S. Kitao, Y. Miyamoto, K. Okai, R. Ozaki, N. Sasao, M. Seto, S. Uetake, A. Yamaguchi, Y. Yoda, A. Yoshimi, and K. Yoshimura, Rev. Sci. Instrum. **88**, 063105 (2017) [DOI: 10.1063/1.4989405].
• A new method of creating high intensity neutron source, T. Masuda, A. Yoshimi, M. Yoshimura, Int. J. Mod. Phys. E 26, 1750076 (2017) [DOI: http://dx.doi.org/10.1142/S0218301317500768].
• Frequency dependence of coherently amplified two-photon emission from hydrogen molecules, H. Hara, Y. Miyamoto, T. Hiraki, T. Masuda, N. Sasao, S. Uetake, A. Yoshimi, K. Yoshimura, and M. Yoshimura, Phys. Rev. A 96, 063827 (2017) [DOI: https://doi.org/10.1103/PhysRevA.96.063827].
• Effects of initial spatial phase in radiative neutrino pair emission, M. Tanaka, K. Tsumura, N. Sasao, S. Uetake, and M. Yoshimura, Phys. Rev. D 96, 113005 (2017) [DOI: https://doi.org/10.1103/PhysRevD.96.113005].
• Externally triggered coherent two-photon emission from hydrogen molecules, Y. Miyamoto, H.Hara, T.Masuda, N.Sasao, M. Tanaka, S. Uetake, A. Yoshimi, K. Yoshimura, M. Yoshimura, Prog. Theor. Exp. Phys. 2015, 081C01 (2015) [DOI: 10.1093/ptep/ptv103].