

# Masaki Uchida

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**Affiliation:** Uchida Laboratory, Department of Physics, School of Science, Tokyo Institute of Technology

**Position:** Associate Professor

**Postal Address:** South Bldg. 5 #107A (S5-4), Ookayama 2-12-1, Meguro-ku, Tokyo 152-8551, JAPAN

**Email:** m.uchida [\*at\_mark\*] phys.titech.ac.jp **Website:** <http://masakiuchida.com> **Tel:** +81-3-5734-2756

**Research Areas:**

molecular beam epitaxy, topological materials, strongly correlated materials, quantum transport, thin film interface

**Appointments:**

- 2020.9-present Associate Professor, Dept. of Phys., Tokyo Institute of Technology
- 2018.10-present PRESTO Researcher, JST (supervised by Prof. Shuichi Murakami)
- 2018.7-2020.8 Lecturer, Dept. of Applied Phys., the University of Tokyo
- 2013.9-2018.6 Research Associate, Dept. of Applied Phys., the University of Tokyo
- 2012.4-2013.8 JSPS Postdoctoral Fellow for Research Abroad (Shen Lab., Cornell University)
- 2009.4-2012.3 JSPS Research Fellow (DC1) (Tokura Lab., the University of Tokyo)

**Education:**

- 2009.4-2012.3 Ph. D. in Applied Physics, the University of Tokyo (supervised by Prof. Yoshinori Tokura)
- 2007.4-2009.3 M. S. in Applied Physics, the University of Tokyo (supervised by Prof. Yoshinori Tokura)
- 2003.4-2007.3 B. S. in Applied Physics, Kyoto University (supervised by Prof. Isao Tanaka)
- 2000.4-2003.3 Asahigaoka High School (Nagoya)

**Publications: (As of September 2020: 55 total publications, 1700+ citations, *h*-index = 21)**

**Review Articles**

- [2] “**Topological Properties and Functionalities in Oxide Thin Films and Interfaces**” [M. Uchida](#) and M. Kawasaki, *Journal of Physics D: Applied Physics* **51**, 143001 (2018).
- [1] “**Topological Oxide Electronics**” in “**The 2016 Oxide Electronic Materials and Oxide Interfaces Roadmap**” [M. Uchida](#) and M. Kawasaki, *Journal of Physics D: Applied Physics* **49**, 433001 (2016).

**Books**

- [1] “**Spectroscopic Study on Charge-Spin-Orbital Coupled Phenomena in Mott-Transition Oxides**” [M. Uchida](#) ISBN: 978-4-431-54296-4 (Springer-Verlag, 2013).

**Original Papers**

- [52] “**Superconductivity in uniquely strained RuO<sub>2</sub> films**” [M. Uchida](#), T. Nomoto, M. Musashi, R. Arita, and M. Kawasaki, *Physical Review Letters* **125**, 147001 (2020) *Selected for Editors’ Suggestion, Featured in Physics*
- [51] “**Characterization of Sr<sub>2</sub>RuO<sub>4</sub> Josephson junctions made of epitaxial films**” [M. Uchida](#), I. Sakuraba, M. Kawamura, M. Ide, K. S. Takahashi, Y. Tokura, and M. Kawasaki, *Physical Review B* **101**, 035107 (2020).
- [50] “**Ferromagnetic state above room temperature in a proximitized topological Dirac semimetal**” [M. Uchida](#), T. Koretsune, S. Sato, M. Kriener, Y. Nakazawa, S. Nishihaya, Y. Taguchi, R. Arita, and M. Kawasaki, *Physical Review B* **100**, 245148 (2019).
- [49] “**Ballistic transport in periodically modulated MgZnO/ZnO two-dimensional electron systems**” K. Tanaka, J. Falson, Y. Kozuka, [M. Uchida](#), D. Maryenko, J. T. Ye, Y. Iwasa, A. Tsukazaki, J. H. Smet, and M. Kawasaki, *Applied Physics Letters* **115**, 153101 (2019). *Selected for Featured Article*
- [48] “**Molecular beam epitaxy of three-dimensionally thick Dirac semimetal Cd<sub>3</sub>As<sub>2</sub> films**” Y. Nakazawa, [M. Uchida](#), S. Nishihaya, S. Sato, A. Nakao, J. Matsuno, and M. Kawasaki, *APL Materials* **7**, 071109 (2019). *Selected for Featured Article*
- [47] “**Quantized surface transport in topological Dirac semimetal films**” S. Nishihaya, [M. Uchida](#), Y. Nakazawa, R. Kurihara, K. Akiba, M. Kriener, A. Miyake, Y. Taguchi, M. Tokunaga, and M. Kawasaki, *Nature Communications* **10**, 2564

(2019).

- [46] “**Anomalous enhancement of upper critical field in Sr<sub>2</sub>RuO<sub>4</sub> thin films**” M. Uchida, M. Ide, M. Kawamura, K. S. Takahashi, Y. Kozuka, Y. Tokura, and M. Kawasaki, *Physical Review B* **99**, 161111(R) (2019).
- [45] “**Ferroelectric field control of charge density in oxide films with polarization reversal by electric double layer**” R. Nishino, Y. Kozuka, F. Kagawa, M. Uchida, and M. Kawasaki, *Applied Physics Letters* **113**, 143501 (2018).
- [44] “**Signatures of charge-order correlations in transport properties of electron-doped cuprate superconductors**” H. Matsuoka, M. Nakano, M. Uchida, M. Kawasaki, and Y. Iwasa, *Physical Review B* **98**, 144506 (2018).
- [43] “**Negative magnetoresistance suppressed through topological phase transition in (Cd<sub>1-x</sub>Zn<sub>x</sub>)<sub>3</sub>As<sub>2</sub> films**” S. Nishihaya, M. Uchida, Y. Nakazawa, K. Akiba, M. Kriener, Y. Kozuka, A. Miyake, Y. Taguchi, M. Tokunaga, and M. Kawasaki, *Physical Review B* **97**, 245103 (2018).
- [42] “**Gate-tuned quantum Hall states in Dirac semimetal (Cd<sub>1-x</sub>Zn<sub>x</sub>)<sub>3</sub>As<sub>2</sub>**” S. Nishihaya, M. Uchida, Y. Nakazawa, M. Kriener, Y. Kozuka, Y. Taguchi, and M. Kawasaki, *Science Advances* **4**, eaar5668 (2018).
- [41] “**Controlling surface carrier density by illumination in the transparent conductor La-doped BaSnO<sub>3</sub>**” E. B. Lochocki, H. Paik, M. Uchida, D. G. Schlom, and K. M. Shen, *Applied Physics Letters* **112**, 181603 (2018).
- [40] “**Structural characterization of high-mobility Cd<sub>3</sub>As<sub>2</sub> films crystallized on SrTiO<sub>3</sub>**” Y. Nakazawa, M. Uchida, S. Nishihaya, M. Kriener, Y. Kozuka, Y. Taguchi, and M. Kawasaki, *Scientific Reports* **8**, 2244 (2018).
- [39] “**Electrical conduction on the surface of ferroelectric PbTiO<sub>3</sub> thin film induced by electrolyte gating**” R. Nishino, Y. Kozuka, M. Uchida, F. Kagawa, and M. Kawasaki, *Applied Physics Letters* **112**, 051602 (2018).
- [38] “**Electric-field control of anomalous and topological Hall effects in oxide bilayer thin films**” Y. Ohuchi, J. Matsuno, N. Ogawa, Y. Kozuka, M. Uchida, Y. Tokura, and M. Kawasaki, *Nature Communications* **9**, 213 (2018). *Selected for Editors' Highlights*
- [37] “**All-in-all-out magnetic domain inversion in Tb<sub>2</sub>Ir<sub>2</sub>O<sub>7</sub> with molecular fields anti-parallel to external fields**” T. C. Fujita, Y. Kozuka, J. Matsuno, M. Uchida, A. Tsukazaki, T. Arima, and M. Kawasaki, *Physical Review Materials* **2**, 011402(R) (2018). *Selected for Editors' Suggestion*
- [36] “**Quantum Hall states observed in thin films of Dirac semimetal Cd<sub>3</sub>As<sub>2</sub>**” M. Uchida, Y. Nakazawa, S. Nishihaya, K. Akiba, M. Kriener, Y. Kozuka, A. Miyake, Y. Taguchi, M. Tokunaga, N. Nagaosa, Y. Tokura, and M. Kawasaki, *Nature Communications* **8**, 2274 (2017). *Selected for Editors' Highlights*
- [35] “**Visualizing ferroic domains in an all-in–all-out antiferromagnet thin film**” Y. Kozuka, T. C. Fujita, M. Uchida, T. Nojima, A. Tsukazaki, J. Matsuno, T. Arima, and M. Kawasaki, *Physical Review B* **96**, 224417 (2017).
- [34] “**Adsorption-controlled growth of La-doped BaSnO<sub>3</sub> by molecular-beam epitaxy**” H. Paik, Z. Chen, E. Lochocki, A. Seidner H., A. Verma, N. Tanen, J. Park, M. Uchida, S. Shang, B.-C. Zhou, M. Brützm, R. Uecker, Z.-K. Liu, D. Jena, K. M. Shen, D. A. Muller, and D. G. Schlom, *APL Materials* **5**, 116107 (2017).
- [33] “**Molecular beam epitaxy growth of superconducting Sr<sub>2</sub>RuO<sub>4</sub> films**” M. Uchida, M. Ide, H. Watanabe, K. S. Takahashi, Y. Tokura, and M. Kawasaki, *APL Materials* **5**, 106108 (2017).
- [32] “**Alloy disorder modulated electron transport at Mg<sub>x</sub>Zn<sub>1-x</sub>O/ZnO heterointerface**” A. Vishnuradhan, Y. Kozuka, M. Uchida, J. Falson, A. Tsukazaki, and M. Kawasaki, *AIP Advances* **7**, 015029 (2017).
- [31] “**Evolution of electronic correlations across the rutile, perovskite, and Ruddelsden-Popper iridates with octahedral connectivity**” J. K. Kawasaki, M. Uchida, H. Paik, D. G. Schlom, and K. M. Shen, *Physical Review B* **94**, 121104(R) (2016).
- [30] “**Evolution of Insulator-Metal Phase Transitions in Epitaxial Tungsten Oxide Films during Electrolyte-Gating**” S. Nishihaya, M. Uchida, Y. Kozuka, Y. Iwasa, and M. Kawasaki, *ACS Applied Materials & Interfaces* **8**, 22330 (2016).
- [29] “**MgZnO/ZnO heterostructures with electron mobility exceeding 1×10<sup>6</sup> cm<sup>2</sup>/Vs**” J. Falson, Y. Kozuka, M. Uchida, J. H. Smet, T. Arima, A. Tsukazaki and M. Kawasaki, *Scientific Reports* **6**, 26598 (2016).
- [28] “**Strain Control of Fermiology and Many-Body Interactions in Two-Dimensional Ruthenates**” B. Burganov, C. Adamo, A. Mulder, M. Uchida, P. D. C. King, J. W. Harter, D. E. Shai, A. S. Gibbs, A. P. Mackenzie, R. Uecker, M.

- Bruetzam, M. R. Beasley, C. J. Fennie, D. G. Schlom, and K. M. Shen, *Physical Review Letters* **116**, 197003 (2016).
- [27] “**All-in-all-out magnetic domain wall conduction in a pyrochlore iridate heterointerface**” T. C. Fujita, M. Uchida, Y. Kozuka, W. Sano, A. Tsukazaki, T. Arima, and M. Kawasaki, *Physical Review B* **93**, 064419 (2016). *Selected for Editors' Suggestion*
- [26] “**Epitaxially Stabilized Oxide Composed of Twisted Triangular-Lattice Layers**” M. Uchida, K. Ohba, Y. Ohuchi, Y. Kozuka, and M. Kawasaki, *Chemistry of Materials* **28**, 1165 (2016).
- [25] “**Effective carrier doping and metallization in  $\text{La}_x\text{Sr}_{2-x-y}\text{Ba}_y\text{IrO}_{4-\delta}$  thin films**” M. Ito, M. Uchida, Y. Kozuka, K. S. Takahashi, and M. Kawasaki, *Physical Review B* **93**, 045139 (2016).
- [24] “**Direct Observation of Electrostatically Driven Band Gap Renormalization in a Degenerate Perovskite Transparent Conducting Oxide**” Z. Lebens-Higgins, D. O. Scanlon, H. Paik, S. Sallis, Y. Nie, M. Uchida, N. F. Quackenbush, M. J. Wahila, G. E. Sterbinsky, Dario A. Arena, J. C. Woicik, D. G. Schlom, and L. F. J. Piper, *Physical Review Letters* **116**, 027602 (2016).
- [23] “**All-in-all-out magnetic domain size in pyrochlore iridate thin films as probed by local magnetotransport**” T. C. Fujita, M. Uchida, Y. Kozuka, S. Ogawa, A. Tsukazaki, T. Arima, and M. Kawasaki, *Applied Physics Letters* **108**, 022402 (2016).
- [22] “**Magnetic properties of spin frustrated spinel  $\text{ZnFe}_2\text{O}_4$  /  $\text{ZnCr}_2\text{O}_4$  superlattices**” T. Murata, Y. Kozuka, M. Uchida, and M. Kawasaki, *Journal of Applied Physics* **118**, 193901 (2015).
- [21] “**Formation and Observation of a Quasi-Two-Dimensional  $d_{xy}$  Electron Liquid in Epitaxially Stabilized  $\text{Sr}_{2-x}\text{La}_x\text{TiO}_4$  Thin Films**” Y. F. Nie, D. Di Sante, S. Chatterjee, P. D. C. King, M. Uchida, S. Ciuchi, D. G. Schlom, and K. M. Shen, *Physical Review Letters* **115**, 096405 (2015).
- [20] “**Field-direction control of the type of charge carriers in nonsymmorphic  $\text{IrO}_2$** ” M. Uchida, W. Sano, K. S. Takahashi, T. Koretsune, Y. Kozuka, R. Arita, Y. Tokura, and M. Kawasaki, *Physical Review B* **91**, 241119(R) (2015). *Selected for Editors' Suggestion*
- [19] “**Band alignment and photovoltaic effect of epitaxial  $\alpha$ -PbO thin films**” E. Majima, Y. Kozuka, M. Uchida, M. Nakamura, and M. Kawasaki, *Applied Physics Express* **8**, 074001 (2015).
- [18] “**Topological Hall effect in Heisenberg ferromagnet EuO thin films**” Y. Ohuchi, Y. Kozuka, M. Uchida, K. Ueno, A. Tsukazaki, M. Kawasaki, *Physical Review B* **91**, 245115 (2015).
- [17] “**Odd-parity magnetoresistance in pyrochlore iridate thin films with broken time-reversal symmetry**” T. C. Fujita, Y. Kozuka, M. Uchida, A. Tsukazaki, T. Arima, and M. Kawasaki, *Scientific Reports* **5**, 9711 (2015).
- [16] “**Calibration and control of in-plane Mg doping distribution in  $\text{Mg}_x\text{Zn}_{1-x}\text{O}/\text{ZnO}$  heterostructures grown by molecular beam epitaxy**” M. Uchida, J. Falson, Y. Segawa, Y. Kozuka, A. Tsukazaki, and M. Kawasaki, *Japanese Journal of Applied Physics* **54**, 028004 (2015).
- [15] “**Interplay of Spin-Orbit Interactions, Dimensionality, and Octahedral Rotations in Semimetallic  $\text{SrIrO}_3$** ” Y. F. Nie, P. D. C. King, C. H. Kim, M. Uchida, H. I. Wei, B. D. Faeth, J. P. Ruf, J. P. C. Ruff, L. Xie, X. Pan, C. J. Fennie, D. G. Schlom, and K. M. Shen, *Physical Review Letters* **114**, 016401 (2015).
- [14] “**Correlated vs. conventional insulating behavior in the  $J_{\text{eff}} = 1/2$  vs.  $3/2$  bands in the layered iridate  $\text{Ba}_2\text{IrO}_4$** ” M. Uchida, Y. F. Nie, P. D. C. King, C. H. Kim, C. J. Fennie, D. G. Schlom, and K. M. Shen, *Physical Review B* **90**, 075142 (2014).
- [13] “**Atomic-scale control of competing electronic phases in ultrathin  $\text{LaNiO}_3$** ” P. D. C. King, H. I. Wei, Y. F. Nie, M. Uchida, C. Adamo, S. Zhu, X. He, I. Božović, D. G. Schlom, and K. M. Shen, *Nature Nanotechnology* **9**, 443–447 (2014).
- [12] “**Evidence for Topologically Protected Surface States and a Superconducting Phase in  $[\text{Ti}_4](\text{Ti}_{1-x}\text{Sn}_x)\text{Te}_3$  Using Photoemission, Specific Heat, and Magnetization Measurements, and Density Functional Theory**” K. E. Arpino, D. C. Wallace, Y. F. Nie, T. Birol, P. D. C. King, S. Chatterjee, M. Uchida, S. M. Koohpayeh, J.-J. Wen, C. J. Fennie, K. M. Shen, and T. M. McQueen, *Physical Review Letters* **112**, 017002 (2014).
- [11] “**Extremely high electron mobility in a phonon-glass semimetal**” S. Ishiwata, Y. Shiomi, M. S. Bahramy, J. S. Lee, T. Suzuki, M. Uchida, R. Arita, Y. Taguchi, and Y. Tokura, *Nature Materials* **12**, 512-517 (2013).

- [10] “A tunable low-energy photon source for high-resolution angle-resolved photoemission spectroscopy” J. W. Harter, P. D. C. King, E. J. Monkman, D. E. Shai, Y. Nie, M. Uchida, B. Burganov, S. Chatterjee, and K. M. Shen, *Review of Scientific Instruments* **83**, 113103 (2012).
- [9] “Pseudogap-related charge dynamics in layered-nickelate  $R_{2-x}Sr_xNiO_4$  ( $x \sim 1$ )” M. Uchida, Y. Yamasaki, Y. Kaneko, K. Ishizaka, J. Okamoto, H. Nakao, Y. Murakami, and Y. Tokura, *Physical Review B* **86**, 165126 (2012).
- [8] “Spin and charge states of Co in half-doped layered cobaltates  $La_{1.5}Ca_{0.5}CoO_4$  and  $La_{1.5}Sr_{0.5}CoO_4$ ” J. S. Lee, Hal. Q. Yamamoto, M. Uchida, and Y. Tokura, *Physical Review B* **86**, 045133 (2012).
- [7] “Charge-gap formation in the insulating states of  $AV_{10}O_{15}$  ( $A = Ba, Sr$ )” M. Hoshino, T. Kajita, T. Kanzaki, M. Uchida, Y. Tokura, and T. Katsufuji, *Physical Review B* **85**, 085106 (2012).
- [6] “Orbital characters of three-dimensional Fermi surfaces in  $Eu_{2-x}Sr_xNiO_4$  as probed by soft-x-ray angle-resolved photoemission spectroscopy” M. Uchida, K. Ishizaka, P. Hansmann, X. Yang, M. Sakano, J. Miyawaki, R. Arita, Y. Kaneko, Y. Takata, M. Oura, A. Toschi, K. Held, A. Chainani, O. K. Andersen, S. Shin, and Y. Tokura, *Physical Review B* **84**, 241109(R) (2011). *Selected for Editors’ Suggestion*
- [5] “Thermoelectric response in the incoherent transport region near Mott transition: the case study of  $La_{1-x}Sr_xVO_3$ ” M. Uchida, K. Oishi, M. Matsuo, W. Koshibae, Y. Onose, M. Mori, J. Fujioka, S. Miyasaka, S. Maekawa, and Y. Tokura, *Physical Review B* **83**, 165127 (2011).
- [4] “Large magnetoresistance and spin-polarized heavy-mass electron state of the doped valence-bond solid  $(Ti_{1-x}V_x)_2O_3$ ” M. Uchida, Y. Onose, and Y. Tokura, *Physical Review B* **83**, 052404 (2011).
- [3] “Pseudogap of metallic layered nickelate  $R_{2-x}Sr_xNiO_4$  ( $R=Nd, Eu$ ) crystals measured using angle-resolved photoemission spectroscopy” M. Uchida, K. Ishizaka, P. Hansmann, Y. Kaneko, Y. Ishida, X. Yang, R. Kumai, A. Toschi, Y. Onose, R. Arita, K. Held, O. K. Andersen, S. Shin, and Y. Tokura, *Physical Review Letters* **106**, 027001 (2011). *Featured in Journal Club for Condensed Matter Physics*
- [2] “Growth of superconducting  $Sr_2RuO_4$  thin films” Y. Krockenberger, M. Uchida, K. S. Takahashi, M. Nakamura, M. Kawasaki, and Y. Tokura, *Applied Physics Letters* **97**, 082502 (2010).
- [1] “Charge dynamics in thermally and doping induced insulator-metal transitions of  $(Ti_{1-x}V_x)_2O_3$ ” M. Uchida, J. Fujioka, Y. Onose, and Y. Tokura, *Physical Review Letters* **101**, 066406 (2008).

#### Research Grants:

- 2018-2021 JST PRESTO “Topological Materials Science for Creation of Innovative Functions”
- 2018-2020 JSPS Grant-in-Aid for Scientific Research (B)
- 2016-2017 JSPS Grant-in-Aid for Scientific Research on Innovative Areas “Topological Materials Science”
- 2015-2016 JSPS Grant-in-Aid for Young Scientists (A)
- 2014-2015 JSPS Grant-in-Aid for Challenging Exploratory Research
- 2012-2013 JSPS Postdoctoral Fellowships for Research Abroad
- 2009-2011 JSPS Research Fellowships for Young Scientists

#### Awards:

- 2020 Young Scientist Award of the Physical Society of Japan (Division 4) (The Physical Society of Japan)
- 2017 Science Poster Prize in CEMS-QPEC Symposium (Science AAAS)
- 2015 Ando Prize for Outstanding Young Scientists (The Foundation of Ando Laboratory)
- 2015 Funai Research Incentive Award (Funai Foundation for Information Technology)
- 2014 Inoue Research Award for Young Scientists (Inoue Foundation for Science)
- 2012 Springer Theses (Springer)

#### Other Foundation Grants:

- |           |  |   |
|-----------|--|---|
| 2020      | The Sumitomo Foundation                        | Grant for Basic Science Research Projects |
| 2020      | The Murata Science Foundation                  | Research Grant                            |
| 2019-2020 | School of Engineering, The University of Tokyo | Support for Young Researchers             |
| 2019      | TEPCO Memorial Foundation                      | General Research Grant                    |

2016	The Foundation for The Promotion of Ion Engineering	Research Grant
2016	The Asahi Glass Foundation	Incentive Research Grant
2016	Iketani Science and Technology Foundation	Research Grant
2016	Yazaki Memorial Foundation for Science and Technology	Incentive Research Grant
2015	The Thermal & Electric Energy Technology Inc. Foundation	Research Grant
2015	Research Foundation for the Electrotechnology of Chubu	Research Grant
2014	The Casio Science Promotion Foundation	Research Grant
2014	The Murata Science Foundation	Research Grant
2014	Toyota Physical and Chemical Research Institute	Scholar Project
2014	Mizuho Foundation for the Promotion of Sciences	Engineering Research Grant