Curriculum Vitae Mingqiang Gu

Contact Information

Department of Physics, Southern University of Science and Technology
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Academic Experiences

2019.11-present Research Associate Professor in Physics
Southern University of Science and Technology
Research Area: *Ultrafast nonlinear physics in quantum topological materials*

2014-2019 Postdoctoral Researcher in Materials Science
Northwestern University
Advisor: Prof. James M. Rondinelli
Research Area: *Design of ultrafast nonlinear optical devices with complex oxides materials.*

2008-2014 Ph.D. in Physics
Nanjing University
Advisor: Prof. Xiaoshan Wu
Doctoral thesis: *Design of interfaces of perovskite superlattices, and their properties*

2011-2013 Exchange Ph.D. Student
Indiana State University
Advisor: Prof. Guoping Zhang

2004-2008 B.E. in Mechanical Engineering
South China University of Technology

Awards

Award for Overseas High-Caliber Personnel (Level B) by Shenzhen in 2020
Awarded National Scholarship for Graduate Students in 2012
Award for Excellent Research for Graduate Student in the National Laboratory of Solid State Microstructures, Nanjing University, in 2012

Fundings

Young innovative talents project in Higher Education of Guangdong, $40000, "Ultrafast optical response in intrinsic magnetic topological materials"
Shenzhen Science and Technology Program, $600000, "Theoretical investigation of phase manipulation through ultrafast THz laser"
Natural Science Foundation of Guangdong Province, $100000, "Special optical

response of intrinsic magnetic topological insulators"

Research experiences

Research on Ultrafast Manipulation of Material Properties

12/2019-present "*Properties and manipulation of intrinsic 2D magnetic topological insulators*": To reveal the novel topological signatures in the magnetic topological insulators. Rational designing the novel topological quantum phases by means of symmetry and structure-properties-relationship. To manipulate the quantum phase transition using ultrafast laser pulse.

11/2014-11/2019 "*Nonlinear phononics as a new route to access novel properties*": To understand the underlying physical origin of ultrafast manipulation of transient properties and theoretically designed new route to access nonequilibrium states that beyond traditional static methods.

Research on Perovskite Superlattice Systems:

10/2010-2014 "*Controlling the material properties in $SrTiO_3/SrRuO_3$ superlattice system*": Designed new methods and structures to manipulate the magnetic and electronic properties in this system. Demonstrated the strain-dependence of the magnetic moment. Obtained different dimensions of the octahedral network, which show distinct properties both in experiment and simulation.

5/2012-11/2012 "*Formation and effects of intrinsic defects at $LaAlO_3/SrTiO_3$ interface*": Investigated the intrinsic point defects and the combined defects on both n- and p- type interfaced in this system, in order to examine the impacts on the electronic structure in this 2-dimensional electron gas system.

4/2009-10/2010 "*Enhanced electric polarization in $PbTiO_3/SrTiO_3$ superlattice*": Investigated the impacts of stacking ordering on ferroelectricity. Established an electrostatic model to estimate the interfacial polarization.

Research on Graphene:

9/2012-3/2013 "*High harmonic generation in graphene nano molecules*": Probed into the possibility of using graphene nano molecules as source of high order harmonic generation. Numerically solved the Liouville equation to obtain the dynamics when photon interacts with the material.

Research on Transition Metals:

5/2013-present "*Spin-phonon effects in transition metal Ni, Co, Fe*": Developed a direct way to view the phonon induced magnetic moment change in the reciprocal space. To sort out the phonon contribution during the ultrafast spin-flip process.

Research Interests

At the moment, my major research interests include:

（1）Ultrafast manipulation of electronic, magnetic, and phononic properties

（2）Band topology of quantum materials

（3）Functional design of strongly correlated materials and topological materials

Publications & Presentations:

1. "Spin–phonon dispersion in magnetic materials" Mingqiang Gu, Y H Bai, G P Zhang and Thomas F George, J. Phys.: Condens. Matter 34 375802 (2022)
2. "Ultrafast suppression of the ferroelectric instability in $KTaO_3$" Viktor Krapivin, Mingqiang Gu, D. Hickox-Young et al., accepted by Phys. Rev. Lett.
3. "Interlayer magnetophononic coupling in $MnBi_2Te_4$" H Padmanabhan, M Poore, PK Kim et. al., Nat. Commun. 13, 1 (2022).
4. "Layer Hall effect induced by hidden Berry curvature in antiferromagnetic insulators" Rui Chen, Hai-Peng Sun, Mingqiang Gu et al., accepted by National Science Review. (Co-first author)
5. "Observation of Magnetism-Induced Topological Edge State in Antiferromagnetic Topological Insulator MnBi4Te7" Hao-Ke Xu, Mingqiang Gu, Fucong Fei et al., ACS Nano 16, 9810 (2022) (Co-first author)
6. "Crossover between Bulk and Interface Photovoltaic Mechanisms in a Ferroelectric Vertical Heterostructure" Abdelsamie, Amr, You, Lu, Wang, Le et al. Phys. Rev. Appl. 17, 024047 (2022)
7. "Pressure-Tuned Intralayer Exchange in Superlattice-Like MnBi2Te4/(Bi2Te3)n Topological Insulators" Shao, Jifeng, Liu, Yuntian, Zeng, Meng, et al. Nano Letters, 21, 5874 (2021)
8. "Correlation between Spin and Orbital Dynamics during Laser-Induced Femtosecond Demagnetization" Zhang, G. P., Gu, Mingqiang, Bai, Y.H. et al. J. Phys. Chem. C 125, 14461 (2021)
9. "Spectral signatures of the surface anomalous Hall effect in magnetic axion insulators" Mingqiang Gu, Jiayu Li, Hongyi Sun, et al., Nat. Comm. **12**, 3524 (2021) (First Author)
10. "Spectral Addressability in a Modular Two Qubit System" S von Kugelgen, MD Krzyaniak, M Gu, et al., J. Am. Chem. Soc. 143, 8069 (2021)
11. "Comprehensive anisotropic linear optical properties of the Weyl semimetals TaAs and NbAs", R Zu, M Gu*, L Min, et al., Phys. Rev. B **103**, 165137 (2021) (Corresponding Author)
12. "Half-Magnetic Topological Insulator with Magnetization-Induced Dirac Gap at a Selected Surface" Ruie Lu, Hongyi Sun, Shiv Kumar, et al., Phys. Rev. X **11**, 011039 (2021)
13. "Extreme tensile strain states in $La_{0.7}Ca_{0.3}MnO_3$ membranes", Seung Sae Hong, Mingqiang Gu, Manish Verma, Di Lu, Varun Harbola, Arturas Vailionis, Yasuyuki Hikita, Rossitza Pentcheva, James M. Rondinelli, Harold Y. Hwang, SCIENCE **386**,

71 (2020)

14. "Multi-messenger nano-probes of hidden magnetism in a strained manganite" A. Mcleod*, J. Zhang*, M. Gu*, F. Jin, G. Zhang, K. W. Post, X. G. Zhao, A. J. Millis, W. Wu, J. M. Rondinelli, R. D. Averitt, D. N. Basov, Nat. Mater. 19, 397 (2020) (Co-First Author)
15. "Uniaxial Strain-Controlled Ground States in Manganite Films" F Jin, M Gu, C Ma, et al., Nano letters 20, 1131 (2020)
16. "Probing single-unit-cell resolved electronic structure modulations in oxide superlattices with standing-wave photoemission" W. Yang, R. U. Chandrasena, M. Gu, R. M. S dos Reis, E. J. Moon, Arian Arab, M-A Husanu, S. Nemšák, E. M. Gullikson, J. Ciston, V. N. Strocov, J. M. Rondinelli, S. J. May, A. X. Gray, Phys. Rev. B **100**, 125119 (2019)
17. "Atomic and electronic structure of domains walls in a polar metal", Greg Stone, Danilo Puggioni, Shiming Lei, Mingqiang Gu, Ke Wang, Yu Wang, Jianjian Ge, Xue-Zeng Lu, Zhiqiang Mao, James M Rondinelli, Venkatraman Gopalan, Phys. Rev. B **99**, 014105 (2019)
18. "Coupled Raman-Raman modes in the ionic Raman scattering process" Mingqiang Gu and James M. Rondinelli, App. Phys. Lett. **113**, 112903 (2018) (First Author)
19. "Nonlinear phononic control and emergent magnetism in Mott insulating titanates" Mingqiang Gu and James M. Rondinelli, Phys. Rev. B **98**, 024102 (2018) (First Author)
20. "Discovery of Cu_3Pb" Alexandra D Tamerius, Samantha M Clarke, Mingqiang Gu, James PS Walsh, Marco Esters, Yue Meng, Christopher H Hendon, James M Rondinelli, Steven D Jacobsen, Danna E Freedman, Angew. Chem. **130**, 12991 (2018)
21. "Structure Dependent Phase Stability and Thermal Expansion of Ruddlesden–Popper Strontium Titanates" Liang-Feng Huang, Nathan Z Koocher, Mingqiang Gu, James M Rondinelli, Chem. Mater. **30**, 7100 (2018)
22. "Observation of Quasi-Two-Dimensional Polar Domains and Ferroelastic Switching in a Metal, Ca3Ru2O7" Shiming Lei, Mingqiang Gu, Danilo Puggioni, Greg Stone, Jin Peng, Jianjian Ge, Yu Wang, Baoming Wang, Yakun Yuan, Ke Wang, Zhiqiang Mao, James M Rondinelli, Venkatraman Gopalan, Nano Lett. **18**, 3088 (2018)
23. "Role of orbital filling on nonlinear ionic Raman scattering in perovskite titanates" Mingqiang Gu and James M. Rondinelli, Phys. Rev. B **95**, 024109 (2017) (First Author)
24. "Mott transition controlled by lattice-orbital coupling in 3d-metal-doped double-layer ruthenates" J. Peng, M. Q. Gu, X. M. Gu, G. T. Zhou, X. Y. Gao, J. Y. Liu, W. F. Xu, G. Q. Liu, X. Ke, L. Zhang, H. Han, Z. Qu, D. W. Fu, H. L. Cai, F. M. Zhang, Z. Q. Mao, and X. S. Wu, Phys. Rev. B **96**, 205105 (2017)
25. "Enhancement of orbital ordering and spin polarization by controlling the dimensionality of the octahedra network" Mingqiang Gu, Kang Wang, Yiming Wang, Qiyun Xie, Hongling Cai, Guo-Ping Zhang and Xiaoshan Wu, npj Quant. Mater. **1**, 16011(2016) (First Author)

26. "Ultrafast Band Engineering and Transient Spin Currents in Antiferromagnetic Oxides" Mingqiang Gu and James M. Rondinelli, Sci. Rep. **6**, 25121 (2016) (First Author)
27. "Ultrafast reduction in exchange interaction by a laser pulse: Alternative path to femtomagnetism" Guoping Zhang, Mingqiang Gu, Xiaoshan Wu, J. Phys.: Condens. Matter **26**, 376001 (2014)
28. "Structural and electronic properties of CdTe:Cl from first-principles" Huiping Zhu, Mingqiang Gu, Lei Huang, Jianli Wang and X.S. Wu, Mater. Chem. Phys. **143**, 637 (2014)
29. *Invited Letter:* "Laser Induced Multiphoton Effects in Nano-Graphene Molecules" Mingqiang Gu, Guoping Zhang and X.S. Wu, Appl. Sci. **3**, 278 (2013). (First Author)
30. "Magnetic ordering and structural phase transitions in a strained ultrathin $SrRuO_3/SrTiO_3$ superlattice" Mingqiang Gu, Qiyun Xie, Xuan Shen, Rubin Xie, Jianli Wang, Gang Tang, Di Wu, Guoping Zhang and X.S. Wu, Phys. Rev. Lett. **109**, 157003 (2012) (First Author)
31. "Stabilities of the Intrinsic Defects on $SrTiO_3$ Surface and $SrTiO_3/LaAlO_3$ Interface" Mingqiang Gu, Jianli Wang, X.S. Wu and Guoping Zhang, J. Phys. Chem: C **116**, 24993 (2012) (First Author)
32. "Defect-induced room temperature ferromagnetism in un-doped InN film" Qiyun Xie, Mingqiang Gu, Lei Huang, F.M. Zhang and X.S. Wu, AIP Advances **2**, 012185 (2012)
33. "The adsorption of O on (001) and (111) CdTe surfaces: A first-principles study" Jianli Wang, Gang Tang, X.S. Wu, and Mingqiang Gu, Thin Solid Films **520**, 3960 (2012)
34. "Stable structure and effects of sulfur in CdTe/CdS heterojunctions" Jianli Wang, Gang Tang, X.S. Wu, and Mingqiang Gu, Surf. Interface Anal. **44**, 434 (2012)
35. "InN doped with Zn: Bulk and surface investigation from first principles" Jianli Wang, Gang Tang, X.S. Wu, and Mingqiang Gu, Solid State Comm. **152**, 1168 (2012)
36. "Microstructures of $YBa_{1.85}Eu_{0.15}Cu_3O_{7-\delta}$ superconducting films grown on $SrTiO_3$ and YSZ substrates" Qiyun Xie, Mingqiang Gu, Bin Qian, X.S. Wu, Zhengsheng, Jiang, Jin zou and Jun Gao, J Cryst. Growth, **318**, 580 (2011)
37. "Stable structure and effects of oxygen on InN (1 0 -1 0) and (1 1 -2 0) surfaces" Jianli Wang, Dongmei Bai, Gang Tang, X.S. Wu, and Mingqiang Gu, J Cryst. Growth **327**, 233 (2011)
38. "Substrate effects on the ordering nanostructure for $La_{2/3}Ca_{1/3}MnO_3$ ultrathin films" Min Fu, Qiyun Xie, Mingqiang Gu, Yamei Zhang, X.S. Wu, Fengming Pan, Xiangcun Chen, Lihui Wu, Guoqiang Pan and Jun Gao, J Cryst. Growth **312**, 1617 (2010)
39. "Structural and electronic properties of $PbTiO_3/SrTiO_3$ superlattices from first principles" Mingqiang Gu, Jianli Wang, Qiyun Xie and X.S. Wu, Phys. Rev. B **82**, 134102 (2010) (First Author)

• Gordon Research Conference 2018, at Galveston, Poster Presentation: *Theoretical*

Design for Ultrafast Linear/Nonlinear Phononic Manipulations in Titanates

- APS March Meeting 2018, at Los Angeles, Oral Presentation: *Three-mode-interactions in the anharmonic phononic coupling process*
- APS March Meeting 2017, at New Orleans, Oral Presentation: *Switching the magnetic ground state in d1 titanates though ultrafast nonlinear phononic coupling*
- APS March Meeting 2016, at Baltimore, Oral Presentation: *Phonon-induced ultrafast band gap control in $LaTiO_3$*
- APS March Meeting 2015, at San Antonio, Oral Presentation: *Controlling the dimensionality of the octahedra network in $SrRuO_3/SrTiO_3$ superlattice*
- APS March Meeting 2015, at San Antonio, Poster Presentation: *Ultrafast dynamics of titanate octahedra tilting modes in a THz laser pulse*
- APS March Meeting 2013, at Baltimore, Oral Presentation: *Laser-induced high harmonic generations in Nano-Graphene Molecules*
- APS March Meeting 2013, at Baltimore, Oral Presentation: *Laser-induced high harmonic generations in Nano-Graphene Molecules*
- APS March Meeting 2013, at Baltimore, Oral Presentation: *Laser-induced high harmonic generations in Nano-Graphene Molecules*
- APS March Meeting 2012, at Boston, Poster Presentation: *Magnetic order and structural phase transition in strained ultrathin $SrRuO_3/SrTiO_3$ superlattice*
- Department Talk at Indiana State University in 2012: *Strain induced phase transitions in $SrRuO_3/SrTiO_3$ superlattice*