

# Srinivas Raghu

Stanford University  
Department of Physics  
McCullough Building, Room 305  
476 Lomita Mall, Stanford CA 94305-4045

Phone: (650) 724-4658  
Email: [sraghu@stanford.edu](mailto:sraghu@stanford.edu)  
Citizenship: United States

## Academic History

Associate Director, Stanford Institute for Theoretical Physics, Condensed Matter Theory Division, 2017-present.

Associate Professor, Department of Physics, Stanford University, July 2017-present.

Associate Professor, Photon Sciences, SLAC National Accelerator Laboratory, July 2017-present.

Assistant Professor, Department of Physics, Stanford University, July 2011-2017.

Assistant Professor, Photon Sciences, SLAC National Accelerator Laboratory, July 2011-2017.

Assistant Professor, Department of Physics and Astronomy, Rice University, July 2010-June 2011.

Postdoctoral Scholar, Stanford University, September 2006-July 2010.

Ph.D. Physics, Princeton University, 2006.

*Advisor:* F. Duncan M. Haldane

*Thesis title:* *Topological Properties of Systems with Broken Time-Reversal Symmetry*

M.A. Physics, Princeton University, 2003.

## Honors and Awards

Elected as Fellow of the American Physical Society (2021).

Alfred P. Sloan Research Fellowship (2012-2015).

Frederick E. Terman Fellowship (2012-2015).

DOE EARLY CAREER Award, funded through Stanford Institute for Materials and Energy Sciences (SIMES) (2012-2017).

## Professional Service

Co-organizer, Aspen Summer Program, *Quantum materials: experimental enigmas and theoretical challenges*, June 2023.

Co-organizer, Aspen Winter Conference, *Progress and application of modern quantum field theory*, Winter 2015.

Co-organizer, KITP workshop, *Bad metals, magnetism and unconventional superconductivity*, Fall 2014.

Co-organizer, Stanford ITP workshop, *Non-Fermi liquids*, April 2014.

Co-organizer, Winter School on Unconventional superconductivity, January 2013.

Chair, Condensed matter seminar committee (2013-2014).

Graduate Admissions Committee (2012-2014).

SLAC Long Term Planning Committee, August-December 2012.

Undergraduate Adviser, Stanford Physics Department, 2011-Present.

Graduate curriculum committee, Stanford Physics Department, 2011-2012.

Referee: Science, Physical Review Letters, Physical Review B, Nature Physics

Referee: NSF, DOE

## Publications

### Peer Reviewed Articles

[1] *Possible realization of directional optical waveguides in photonic crystals with broken time-reversal symmetry.* F. D. M. Haldane and **S. Raghu**. Phys. Rev. Lett. **100**, 013904 (2008).

[2] *Analogs of quantum-Hall-effect edge states in photonic crystals.* **S. Raghu**, and F. D. M. Haldane. Phys. Rev. A **78**, 033834 (2008).

[3] *Nernst effect and diamagnetism in phase fluctuating superconductors.* D. Podolsky, **S. Raghu**, and A. Vishwanath. Phys. Rev. Lett. **99**, 117004 (2007).

[4] *Theory of the three dimensional quantum Hall effect in graphite.* B. A. Bernevig, T. Hughes, **S. Raghu**, and D. Arovas. Phys. Rev. Lett. **99**, 146804 (2007).

[5] *Topological Mott insulators.* **S. Raghu**, X.-L. Qi, C. Honerkamp, and S.-C. Zhang. Phys. Rev. Lett. **100**, 156401 (2008).

[6] *Vortex-dynamics approach to the Nernst effect in extreme type-II superconductors dominated by phase fluctuations.* **S. Raghu**, D. Podolsky, A. Vishwanath, and D.-A. Huse. Phys. Rev. B **78**, 184520 (2008).

[7] *Time-Reversal Invariant Topological Superconductors and Superfluids in Two and Three Dimensions.* X.-L. Qi, T. Hughes, **S. Raghu**, and S.-C. Zhang. Phys. Rev. Lett. **102** 187001 (2009).

[8] *Pairing strengths for a two orbital model of the Fe-pnictides.* X.-L. Qi, **S. Raghu**, C.-X. Liu, D. J. Scalapino, and S.-C. Zhang. arXiv:0804.4332.

[9] *Minimal two-band model of the superconducting iron oxypnictides.* **S. Raghu**, X.-L. Qi, C.-X. Liu, D. J. Scalapino, and S.-C. Zhang. Phys. Rev. B **77**, 220503 (2008).

[10] *Microscopic theory of the nematic phase in  $\text{Sr}_3\text{Ru}_2\text{O}_7$ .* **S. Raghu**, A. Paramakanti, E.-A. Kim, S. Grigera, A. Mackenzie, and S. A. Kivelson. Phys. Rev. B **79**, 214402 (2009).

- [11] *Collective Modes of a Helical Liquid*. **S. Raghu**, S. B. Chung, X.-L. Qi, and S.-C. Zhang. Phys. Rev. Lett. **104**, 116401 (2010).
- [12] *Superconductivity in the repulsive Hubbard model: an asymptotically exact weak-coupling solution*. **S. Raghu**, S. Kivelson and D. Scalapino. Phys. Rev. B **81** 224505 (2010).
- [13] *Hidden quasi-one-dimensional superconductivity in  $\text{Sr}_2\text{RuO}_4$* . **S. Raghu**, A. Kapitulnik, and S. A. Kivelson. Phys. Rev. Lett. **105**, 136401 (2010).
- [14] *Superconductivity from repulsive interactions in the two dimensional electron gas*. **S. Raghu**, and S. A. Kivelson. Phys. Rev. B **83**, 094518 (2011).
- [15] *Topological density wave states of higher angular momentum*. Chen-Hsuan Hsu, **S. Raghu** and Sudip Chakravarty. Phys. Rev. B. **84**, 155111 (2011).
- [16] *Field-induced p-wave superconducting state of mesoscopic systems*. Jiawei Huo, Wei-Qiang Chen, **S. Raghu** and F. C. Zhang. Phys. Rev. Lett. **108** 257002 (2012).
- [17]  *$\text{Sr}_3\text{Ru}_2\text{O}_7$ : Thermodynamics of phase formation in the quantum critical metal  $\text{Sr}_3\text{Ru}_2\text{O}_7$* . A.W. Rost, S.A. Grigera, J.A.N. Bruin, R.S. Perry, D. Tian, **S. Raghu**, S.A. Kivelson, and A.P. Mackenzie, Proceedings of the National Academy of Sciences **108**, 40, p16549-16553 (2011).
- [18] *Effects of longer-ranged interactions on unconventional superconductivity*. **S. Raghu**, E. Berg, A. Chubukov and S.A. Kivelson. Phys. Rev. B **85**, 024516 (2012).
- [19] *Majorana zero modes in a quantum Ising chain with longer-ranged interactions*. Yuezhen Niu, Suk Bum Chung, Chen-Hsuan Hsu, Ipsita Mandal, **S. Raghu**, and Sudip Chakravarty. Phys. Rev. B **85**, 035110 (2012).
- [20] *Charge and spin collective modes in a quasi-one-dimensional model of  $\text{Sr}_2\text{RuO}_4$* . Suk Bum Chung, **S. Raghu**, A. Kapitulnik, S.A. Kivelson. Phys. Rev. B **86**, 064525 (2012).
- [21] *Optimal  $T_c$  of cuprates: The role of screening and reservoir layers*. **S. Raghu**, R. Thomale, and T. H. Geballe. Phys. Rev. B **86**, 094506 (2012).
- [22] *Theory of ‘hidden’ quasi-1D superconductivity in  $\text{Sr}_2\text{RuO}_4$* . **S. Raghu**, Suk Bum Chung, and Samuel Lederer, J. Phys.: Conf. Ser. **449** 012031 (2013).
- [23] *Spin-orbit coupling in  $\text{LaAlO}_3/\text{SrTiO}_3$  interfaces: magnetism and orbital ordering*. Mark H. Fischer, **S. Raghu**, and Eun-Ah Kim, New J. Phys. **15** 023022 (2013).
- [24] *Kerr effect as evidence of gyrotropic order in the cuprates*. P. Hosur, A. Kapitulnik, S. Kivelson, J. Orenstein and **S. Raghu**, Phys. Rev. B **87** 115116 (2013) [Editor’s selection].
- [25] *Higher angular momentum pairing from transverse gauge interactions*. S. Chung, I. Mandal, **S. Raghu**, and S. Chakravarty, Phys. Rev. B **88** 045127 (2013).
- [26] *Band-structure effects on superconductivity in Hubbard models*. W. Cho, R. Thomale, **S. Raghu**, and S. Kivelson, Phys. Rev. B **88** 064505 (2013) [Editor’s selection].
- [27] *Quantum critical metals in  $d = 3 + 1$* . R. Mahajan, D. Ramirez, S. Kachru and **S. Raghu**, Phys. Rev. B **88** 115116 (2013).
- [28] *Non-Fermi liquid fixed point in a Wilsonian theory of quantum critical metals*. A. Liam Fitzpatrick, S. Kachru, J. Kaplan and **S. Raghu**, Phys. Rev. B **88** 125116 (2013) [Editor’s selection].

- [29] *Particle-hole condensates of higher angular momentum in hexagonal systems.* A. Maharaj, R. Thomale and **S. Raghu**, Phys. Rev. B **88** 205121 (2013).
- [30] *Tunable Coupling of Two-Dimensional Superconductors in Bilayer SrTiO<sub>3</sub> Heterostructures.* Hisashi Inoue, Minu Kim, Christopher Bell, Yasuyuki Hikita, **S. Raghu**, and Harold Y. Hwang, Phys. Rev. B **88** 241104(R) (2013).
- [31] *Non-Fermi liquid behavior of large  $N_B$  quantum critical metals.* A. Liam Fitzpatrick, S. Kachru, J. Kaplan and **S. Raghu**, Phys. Rev. B **89** 165114 (2014).
- [32] *Anomalous Fermi liquid phase in metallic Skyrmion crystals .* Haruki Watanabe, S. A. Parameswaran, **S. Raghu**, and Ashvin Vishwanath, Phys. Rev. B **90** 045145 (2014).
- [33] *Criss-crossed stripe order from interlayer tunneling in hole-doped cuprates* A. Maharaj, Pavan Hosur, and **S. Raghu**, Phys. Rev. B **90** 125108 (2014).
- [34] *Slow Fermions in Quantum Critical Metals* A. Liam Fitzpatrick, Shamit Kachru, Jared Kaplan, Steven A. Kivelson, and **S. Raghu**, arXiv:1402.5413.
- [35] *Suppression of spontaneous currents in Sr<sub>2</sub>RuO<sub>4</sub> by surface disorder* Samuel Lederer, Wen Huang, Edward Taylor, **S. Raghu**, and Catherine Kallin, Phys. Rev. B **90**, 134521 (2014).
- [36] *Evidence for a nematic component to the Hidden Order parameter in URu<sub>2</sub>Si<sub>2</sub> from differential elastoresistance measurements* Scott C. Riggs, M.C. Shapiro, A. Maharaj, **S. Raghu**, E.D. Bauer, R.E. Baumbach, P. Giraldo-Gallo, Mark Wartenbe, and I.R. Fisher, Nature Communications **6**, 6425 (2015).
- [37] *Kerr effect as evidence of gyrotropic order in the cuprates - revisited* Pavan Hosur, A. Kapitulnik, S.A. Kivelson, J. Orenstein, **S. Raghu**, W. Cho, and A. Fried, Phys. Rev. B **91**, 039908 (2015).
- [38] *Enhanced pairing of quantum critical metals near  $d = 3 + 1$*  A. Liam Fitzpatrick, S. Kachru, J. Kaplan, **S. Raghu**, G. Torroba, H. Wang, Phys. Rev. B **92**, 045118 (2015).
- [39] *Elastoconductivity as a probe of broken mirror symmetries* Patrik Hlobil, Akash V. Maharaj, Pavan Hosur, M.C. Shapiro, I.R. Fisher, and **S. Raghu**, Phys. Rev. B **92**, 035148 (2015).
- [40] *Spin triplet superconductivity in a weak-coupling Hubbard model for the quasi-one-dimensional compound Li<sub>0.9</sub>Mo<sub>6</sub>O<sub>17</sub>* Weejee Cho, Christian Platt, Ross H. McKenzie, and **S. Raghu**, Phys. Rev. B **92**, 134514 (2015).
- [41] *Metallic quantum critical points with finite BCS couplings* , **S. Raghu**, Gonzalo Torroba, and Huajia Wang, Phys. Rev. B **92**, 205104 (2015) [Editor's selection].
- [42] *Composite fermions and the field-tuned superconductor-insulator transition* , Michael Mulligan and **S. Raghu**, Phys. Rev. B **93**, 205116 (2016).
- [43] *Topological properties of ferromagnetic superconductors* , Alfred K.C. Cheung and **S. Raghu**, Phys. Rev. B **93**, 134516 (2016).
- [44] *Spin-orbit coupling and odd-parity superconductivity in the quasi-one-dimensional compound Li<sub>0.9</sub>Mo<sub>6</sub>O<sub>17</sub>* , Christian Platt, Weejee Cho, Ross H. McKenzie, Ronny Thomale, and **S. Raghu**, Phys. Rev. B **93**, 214515 (2016).
- [45] *Emergent particle-hole symmetry in the half-filled Landau level* , Michael Mulligan, **S. Raghu**, and M.P.A. Fisher, Phys. Rev. B **94**, 075101 (2016) [Editor's selection].

- [46] *Polaronic behavior in a weak coupling superconductor* , Adrian G. Swartz, Hisashi Inoue, Tyler A. Merz, Yasuyuki Hikita, **S. Raghu**, Thomas P. Devereaux, Steven Johnston, Harold Y. Hwang, PNAS **115**, 1475 (2018).
- [47] *Weiss oscillations and particle-hole symmetry at the half-filled Landau level*, Alfred K.C. Cheung, **S. Raghu**, Michael Mulligan, Phys. Rev. B **95**, 235424 (2016).
- [48] *Non-Fermi liquid Superconductivity: Eliashberg versus the Renormalization group*, Huajia Wang, **S. Raghu**, Gonzalo Torroba, Phys. Rev. B **95**, 165137 (2017).
- [49] *Two dimensional metallic phases from disordered QED<sub>3</sub>*, Pallab Goswami, Hart Goldman, **S. Raghu**, Phys. Rev. B **95**, 235145 (2017).
- [50] *Two-dimensional conductors with interactions and disorder from particle-vortex duality*, Hart Goldman, Michael Mulligan, **S. Raghu**, Gonzalo Torroba, M. Zimet, Phys. Rev. B **96**, 245140 (2017).
- [51] *Exact Boson-Fermion Duality on a 3D Euclidean Lattice*, Jing-Yuan Chen, Jun Ho Son, Chao Wang, **S. Raghu**, Phys. Rev. Lett. **120**, 016602 (2018).
- [52] *Superconducting tunneling spectroscopy of spin-orbit coupling and orbital depairing in Nb:SrTiO<sub>3</sub>*, Adrian G. Swartz, Alfred K. C. Cheung, Hyeok Yoon, Zhuoyu Chen, Yasuyuki Hikita, **S. Raghu**, Harold Y. Hwang, Phys. Rev. Lett. **121**, 167003 (2018).
- [53] *Topological phase transition underpinning particle-hole symmetry in the Halperin-Lee-Read theory* , Prashant Kumar, M. Mulligan **S. Raghu**, Phys. Rev. B **98**, 115105 (2018).
- [54] *The density and disorder tuned superconductor-metal transition in two dimensions*, Zhuoyu Chen, Adrian G. Swartz, Hyeok Yoon, Hisashi Inoue, Tyler Merz, Di Lu, Yanwu Xie, Hongtao Yuan, Yasuyuki Hikita, **S. Raghu**, Harold Y. Hwang, Nature Comm. **9**, 4008 (2018).
- [55] *Residual spin susceptibility in the spin-triplet, orbital-singlet model* , Yue Yu, Alfred K. C. Cheung, **S. Raghu**, D. F. Agterberg, Phys. Rev. B **98**, 184507 (2018).
- [56] *Duality Web on a 3D Euclidean Lattice and Manifestation of Hidden Symmetries* , Jun Ho Son, Jing-Yuan Chen, **S. Raghu**, J. High Energy Phys. **06**, 038 (2019).
- [57] *Composite fermion Hall conductivity and the half-filled Landau level*, Prashant Kumar, **S. Raghu**, M. Mulligan, Phys. Rev. B **99**, 235114 (2019).
- [58] *Emergent reflection symmetry from non-relativistic composite fermions*, Prashant Kumar, M. Mulligan, and **S. Raghu**, Phys. Rev. B **99**, 205151 (2019).
- [59] *Effect of strain inhomogeneity on a chiral p-wave superconductor*, Yue Yu, **S. Raghu**, Phys. Rev. B **100**, 094517 (2019).
- [60] *Pronounced drop of <sup>17</sup>O NMR Knight shift in superconducting state of Sr<sub>2</sub>RuO<sub>4</sub>*, A. Pustogow, Yongkang Luo, A. Chronister, Y. -S. Su, D. A. Sokolov, F. Jerzembeck, A. P. Mackenzie, C. W. Hicks, N. Kikugawa, **S. Raghu**, E. D. Bauer, S. E. Brown, Nature **574**, 72 (2019).
- [61] *Two dimensional non-Fermi liquid metals: a solvable large N limit*, Jeremias Aguilera Damia, Shamit Kachru, **S. Raghu**, Gonzalo Torroba, Phys. Rev. Lett. **123**, 069402 (2019).
- [62] *Self-duality of the integer quantum Hall to insulator transition: a composite fermion description*, Prashant Kumar, Yong Baek Kim, **S. Raghu**, arXiv:1907.13141 (2019), Phys. Rev. B. **100** 235124 (2019).

- [63] *Robust  $d_{x^2-y^2}$ -wave superconductivity of infinite-layer nickelates*, Xianxin Wu, Domenico Di Sante, Tilman Schwemmer, Werner Hanke, Harold Y. Hwang, **S. Raghu**, Ronny Thomale, Phys. Rev. B **101** 060504(R) (2020).
- [64]  *$T_c$  and Pauli limited critical field of  $Sr_2RuO_4$ : uniaxial strain dependence*, Yue Yu, Stuart Brown, **S. Raghu**, Kun Yang, Phys. Rev. B **102** 014509 (2020).
- [65] *Interaction-induced metallicity in a two-dimensional disordered non-Fermi liquid*, Pavel Nosov, Igor Burmistrov, **S. Raghu**, Phys. Rev. Lett. **125** 256604 (2020).
- [66] *3D Network model for strong topological insulator transitions*, Jun Ho Son, **S. Raghu**, Phys. Rev. B **104** 125142 (2021).
- [67] *Numerical study of a dual representation of the integer quantum Hall transition*, Kevin Huang, **S. Raghu**, Prashant Kumar, Phys. Rev. Lett. **126** 056802 (2021).
- [68] *Universal behavior of the bosonic metallic ground state in a two-dimensional superconductor*, Zhuoyu Chen, Bai Y. Wang, Adrian G. Swartz, Hyeok Yoon, Yasuyuki Hikita, **S. Raghu**, Harold Y. Hwang, npj Quantum Mater. **6** 15 (2021).
- [69] *Majorana fermion arcs and the local density of states of  $UTe_2$* , Yue Yu, Vidya Madhavan, **S. Raghu**, Phys. Rev. B. **105** 174520 (2022).
- [70] *The Hubbard Model*, D. Arovas, E. Berg, S. Kivelson, **S. Raghu**, Ann. Rev. Cond. Matt. Phys. **13** 239 (2022).
- [71] *Theory of superconductivity in doped quantum paraelectrics*, Yue Yu, Chen, Harold Y. Hwang, **S. Raghu**, Suk Bum Chung, npj Quantum Mater. **7** 63 (2022).
- [72] *Interaction effects on quantum Hall transitions: dynamical scaling laws and superuniversality*, Prashant Kumar, P.A. Nosov, **S. Raghu** Phys. Rev. Research. **4** 033146 (2022).
- [73] *Quenched randomness, thermal fluctuations and reentrant superconductivity: application to  $UTe_2$* , Yue Yu, **S. Raghu** Phys. Rev. B **105** 174506 (2022).
- [74] *Random singlet-like phase of disordered Hubbard chains*, Josephine Yu, Hong-Chen Jiang, Rahul Nandkishore, **S. Raghu** Phys. Rev. B **106** 075123 (2022).

### Preprints

- [1] *Low-density superconductivity in  $SrTiO_3$  bounded by the adiabatic criterion*, Hyeok Yoon, Adrian G. Swartz, Shannon Harvey, Hisashi Inoue, Yasuyuki Hikita, Yue Yu, Suk Bum Chung, **S. Raghu**, Harold Y. Hwang, arXiv:2106.10802.
- [2] *Character of the “normal state” of the nickelate superconductors*, Kyuho Lee, Bai Yang Wang, Motoki Osada, Berit H. Goodge, Tiffany C. Wang, Yonghun Lee, Shannon Harvey, Woo Jin Kim, Yijun Yu, Chaitanya Murthy, **S. Raghu**, Lena F. Kourkoutis, Harold Y. Hwang arXiv:2203.02580.
- [3] *Pair density wave order from electron repulsion*, Yi-Ming Wu, Pavel Nosov, Aavishkar Patel, **S. Raghu** arXiv:2209.09254.
- [4] *Sublattice Interference promotes Pair Density Wave order in Kagome Metals*, Yi-Ming Wu, Ronny Thomale, **S. Raghu** arXiv:2211.01388.
- [5] *Interplay of superconductivity and localization near a 2D ferromagnetic quantum critical point*, P.A. Nosov, I.S. Burmistrov, **S. Raghu** arXiv:2211.02268.