

RESUME

DEPARTMENT OF PHYSICS AND ASTRONOMY IOWA STATE UNIVERSITY

(2/12/2015)

REBECCA FLINT

Assistant Professor

B-base
Grad. Faculty-Full

ACADEMIC POSITIONS

Assistant Professor
Iowa State University, Ames, IA

2013-present

Simons Postdoctoral Fellowship, Condensed Matter Theory
Massachusetts Institute of Technology, Cambridge, MA

2010-2013

EDUCATION

Ph.D., Physics
Rutgers University, New Brunswick, NJ
Thesis supervisor: Piers Coleman
Symplectic- N in strongly correlated materials

2004-2010

B.Sc. with Honors, Physics
California Institute of Technology, Pasadena, CA

2000-2004

PROFESSIONAL ACTIVITIES

EDITORIAL ACTIVITIES

Referee for Physical Review Letters, Physical Review B, Physical Review X, New Journal of Physics, Physica A, and Science.
Grant proposal referee for DOE, NSF and US-Israel Binational Science Foundation

SERVICE

Institute for Complex Adaptive Material (ICAM) Ames Laboratory Representative
Fellowship Selection Committee Member
Science Steering Committee Member
Neutron Scattering Search Committee Member
Graduate Admissions Committee Member

HONORS, AWARDS

Richard J. Plano Dissertation Prize,
Department of Physics and Astronomy, Rutgers University

April 2011

REFEREED PUBLICATIONS IN PRINT

1. Rebecca Flint, M. Dzero and P. Coleman, *Heavy Electrons and the symplectic symmetry of spin*, Nature Physics **4**, 643 (2008).
2. Rebecca Flint and P. Coleman, *Symplectic N and time reversal in frustrated magnetism*, Phys. Rev. **B 79**, 014424 (2009).
3. R. Flint, H.-T. Yi, P. Chandra, S.-W. Cheong and V. Kiryukhin, *Magnetization and Spin State Crossover in Multiferroic $\text{Ca}_3\text{CoMnO}_3$* , Phys. Rev. **B 81**, 092402 (2010).
4. Rebecca Flint and Piers Coleman, *Tandem Pairing in Heavy Fermion Superconductors*, Phys. Rev. Lett. **105**, 246404 (2010).
5. Rebecca Flint, Andriy Nevidomskyy and Piers Coleman, *Composite pairing in a mixed valent two channel Anderson model*, Phys. Rev. **B 84**, 064514 (2011)
6. Rebecca Flint and Piers Coleman, *The symplectic- N t - J model and s_{\pm} superconductors*, Phys. Rev. **B 86**, 184508 (2012)
7. Rebecca Flint, Premala Chandra and Piers Coleman, *Basal Plane Nonlinear Susceptibility: A Direct Probe of the Single-Ion Physics in URu_2Si_2* , Phys. Rev. **B 86**, 155155 (2012) .
8. Premala Chandra, Piers Coleman and Rebecca Flint, *Hastatic order in URu_2Si_2* , Nature **493**, 621 (2013) .
9. Rebecca Flint and T. Senthil, *Chiral RKKY effect in $\text{Pr}_2\text{Ir}_2\text{O}_7$* , Phys. Rev. **B 87**, 125147 (2013).
10. Rebecca Flint and P.A. Lee, *Emergent honeycomb lattice in $\text{LiZn}_2\text{Mo}_3\text{O}_8$* , Phys. Rev. Lett. **111**, 217201 (2013).
11. Rebecca Flint, Premala Chandra and Piers Coleman, *Hidden and Hastatic Orders in URu_2Si_2* , J. Phys. Soc. Jpn. **83**, 061003 (2014).
12. Rebecca Flint and Piers Coleman, *Spins, electrons and broken symmetries: Realizations of two-channel Kondo physics*, Comptes Rendus Physiques **15**, 557 (2014).
13. Premala Chandra, Piers Coleman and Rebecca Flint, *Ising Quasiparticles and Hidden Order in URu_2Si_2* , Philosophical Magazine **94**, 3803 (2014).
14. Hyunsoo Kim, M. A. Tanatar, R. Flint, C. Petrovic, Rongwei Hu, B. D. White, I. K. Lum, M. B. Maple and R. Prozorov, *Evolution of the superconducting energy gap structure concomitant with Fermi surface reconstruction in the heavy-fermion superconductor CeCoIn_5* , Phys. Rev. Lett. **114**, 027003 (2015).
15. Onur Erten, Rebecca Flint and Piers Coleman, *Molecular Pairing and Fully-Gapped Superconductivity in Yb doped CeCoIn_5* , Phys. Rev. Lett. **114**, 027002 (2015).

CITATIONS (FROM SCIENCE CITATION INDEX)

2010 – 14, 2011 – 17, 2012 – 28, 2013 – 31, 2014 – 63, 2015 - 2 (Total in lifetime: 164, total self-citations: 14)

INVITED PAPERS, TALKS

1. Premala Chandra, Piers Coleman and Rebecca Flint, *Origin of the Large Anisotropy in the χ^3 Anomaly in URu_2Si_2* , Conference Proceedings from Materials and Mechanisms of

- Superconductivity 2012, Washington, D.C. , Journal of Physics Conference Series, 449 UNSP 012026 (2013)
2. Rebecca Flint, *Hidden (hastatic) order in URu₂Si₂: hybridization with a twist*, Condensed Matter Seminar at University of Minnesota, February 2015.
 3. Rebecca Flint, *Hidden (hastatic) order in URu₂Si₂*, Condensed Matter Seminar at University of Oklahoma, November 2014.
 4. Rebecca Flint, *Hidden (hastatic) order in URu₂Si₂*, ICMT seminar at University of Illinois, Urbana-Champaign, October 2014.
 5. Rebecca Flint, *Charge aspects of Composite Pair Superconductivity*, KITP conference "Strong Correlations and Unconventional Superconductivity", September 2014.
 6. Rebecca Flint, *Stabilizing spin liquids: new ingredients*, Gordon Research Conference, Correlated Electron Systems, June 2014.
 7. Rebecca Flint, *Charge aspects of composite pairing*, APS March Meeting (Denver, CO), March 2014.
 8. Rebecca Flint, *Hidden (hastatic) order in URu₂Si₂*, University of Michigan, Ann Arbor, Condensed Matter Seminar, February 2014
 9. Rebecca Flint, Aspen Winter Conference "Unconventional Order in Strongly Correlated Electron Systems", Invited Talk on *Hidden (hastatic) order in URu₂Si₂*, January 2014
 10. Rebecca Flint, *Hidden (hastatic) order in URu₂Si₂*, California Institute of Technology, Condensed Matter Seminar October 2013
 11. Rebecca Flint, *Hidden (hastatic) order in URu₂Si₂*, Strongly Correlated Electron Systems, Tokyo, Japan, Invited Talk, August 2013
 12. Rebecca Flint, *Spins, electrons and broken symmetries: manifestations of two-channel Kondo physics*, Actinides 2013, Karlsruhe, Germany, Invited Talk, July 2013
 13. Rebecca Flint, *Stabilizing spin liquids: Two new ingredients*, Condensed Matter Seminar, Karlsruhe Institute of Technology, July 2013
 14. Rebecca Flint, *Hidden (hastatic) order in URu₂Si₂*, Argonne Materials Science Division Seminar , March 2013.
 15. Rebecca Flint, *Hidden (hastatic) order in URu₂Si₂*, Iowa State University Physics and Astronomy Colloquium , February 2013
 16. Rebecca Flint, *Hidden (hastatic) order in URu₂Si₂*, Innovations in Strongly Correlated Electronic Systems: School and Workshop (ICTP Trieste) , Invited Talk, August 2012
 17. Rebecca Flint, *Composite order and tandem pairing in the 115 family* , Materials and Mechanisms of Superconductivity , Washington DC, Invited Talk, July 2012.
 18. Rebecca Flint, *Chiral RKKY effect in Pr₂Ir₂O₇ and Hastatic order in URu₂Si₂* , Simons Postdoctoral Fellows Meeting (Stonybrook, NY) , April 2012
 19. Rebecca Flint, *Spins, electrons and broken symmetries: new perspectives on heavy fermion materials* , Rutgers University, Physics Colloquium , December 2012.
 20. Rebecca Flint, *How spins become pairs: local pairing in heavy fermion superconductors*, Gordon Research Conference: Superconductivity , Invited Talk, June 2011.
 21. Rebecca Flint, *How spins become pairs: composite pairing and magnetism in heavy fermion superconductors* , APS March Meeting (Dallas, TX), March, 2011.
 22. Rebecca Flint, *How spins become pairs: composite pairing and magnetism in heavy fermion superconductors* , Princeton Condensed Matter Seminar , October 2010
 23. Rebecca Flint, Andriy Nevidomskyy and Piers Coleman, *Composite Pairing in a mixed valent two channel Anderson model* , Plutonium Futures - The Science 2010 (Keystone, CO) , Invited Talk, September 2010
 24. Rebecca Flint, *How spins become pairs: composite pairing and magnetism in heavy fermion superconductors* . Principles and Design of Strongly Correlated Electronic Systems (ICTP

- Trieste) , Invited Talk, August 2010
25. Rebecca Flint, *How spins become pairs: composite pairing and magnetism in heavy fermion superconductors* . Massachusetts Institute of Technology Condensed Matter Seminar , January 2010
 26. Rebecca Flint, *How spins become pairs: composite pairing and magnetism in heavy fermion superconductors* . University of Illinois, Urbana-Champaign Condensed Matter Seminar , January 2010.

CONTRIBUTED PAPERS, TALKS

1. Rebecca Flint and Patrick A. Lee, *LiZn₂Mo₃O₈: honeycomb spin liquid in a triangular lattice material?* , APS March Meeting Contributed Talk , March 2013.
2. Rebecca Flint and T. Senthil, *Chiral RKKY effect in Pr₂Ir₂O₇* , APS March Meeting Contributed Talk , March 2012.
3. Rebecca Flint and Piers, Coleman, *How spins become pairs: composite pairing and magnetism in heavy fermion superconductors* , Strongly Correlated Electron Systems (Santa Fe, NM) Contributed Talk, June 2010
4. Rebecca Flint and Piers Coleman, *Symplectic-N , the $t - J_1 - J_2$ model and the iron-based superconductors* , APS March Meeting Contributed Talk , March 2010.
5. Rebecca Flint, Maxim Dzero and Piers Coleman, *Two Channel Kondo Effect and Superconductivity in Pu and Np Compounds* , APS March Meeting Contributed Talk , March 2009.

RESEARCH SUMMARY

My research lies on the theoretical side of strongly correlated materials, with a dual focus on developing theoretical techniques and realizing exotic phases in real materials. Within strongly correlated materials, the bulk of my work is in heavy fermion physics and frustrated magnetism.

Most heavy fermion physics is described by single channel Kondo physics, where local moments interact antiferromagnetically with a single type of conduction electron. However, sometimes two types of conduction electrons with different symmetries can screen the same local moment, leading to two channel Kondo physics and the possibility of new exotic phases and criticalities. There are two main classes of exotic phases, where the conduction electrons can bind to the local moment either as a particle-particle or particle-hole pair, forming composite pair superconductors or hastatic order, respectively; both phases can be thought of as symmetry breaking heavy Fermi liquids – composite pairing breaks U(1) gauge symmetry, while hastatic order breaks time-reversal symmetry. Composite pairing may be relevant in the 115 superconductors, so my current work in this area is on how to conclusively resolve any composite pair contribution from the more mundane magnetically mediated Cooper pairs. Hastatic order was initially proposed for URu₂Si₂, a tetragonal system, and I am now exploring how hastatic order manifests in cubic systems with quadrupolar doublets, how hastatic order fits into the Doniach picture of quantum criticality and how to generalize the theoretical treatment to capture triplet superconductivity in UBe₁₃. Beyond two-channel Kondo physics, I am examining how Kondo correlations develop in real materials, where there is a large gap between the development of single ion Kondo physics and the coherence of the Kondo lattice, where my focus is on mixed valent materials.

When magnetic interactions are sufficiently frustrated, the magnetic moments can evade long range order to form a highly correlated quantum state without any broken symmetries known as a spin liquid,

which can realize both fractional excitations and topological order. These spin liquids are extraordinarily difficult to find, in nature as well as in realistic models. I have been examining different ways to theoretically “boost” a spin liquid state over more traditional competing states by adding perturbations – either extra weakly coupled magnetic moments or electrons, and then examining the resulting phases in detail.

Strongly correlated electronic systems require new theoretical tools, as traditional perturbative techniques fail. Large-N theories provide a type of controlled mean-field theory that has been very successful in treating “singlet” problems like superconductivity and frustrated magnets in the absence of field; part of my current research program is to extend these large-N ideas to triplet systems, including triplet superconductors like UBe_{13} , Hund's coupled systems and frustrated magnets in field.