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Professional Experience

The United States Naval Academy, Annapolis, Maryland.

Assistant Professor of Physics **Aug. 2015–present**

Western Washington University, Bellingham, Washington.

Assistant Professor of Physics **Sept. 2012–June 2015**

Harvard-Smithsonian Center for Astrophysics and Harvard University Department of Physics, Cambridge, Massachusetts.

ITAMP Postdoctoral Fellow **Sept. 2009–Sept. 2012**

University of Colorado, Boulder, Colorado.

Graduate researcher associate under Prof. Chris H. Greene **Jan. 2005–May 2009**

Education

University of Colorado, Boulder, Colorado

Ph.D. Physics: Aug. 2004–April 2009

- Dissertation Topic: *Control and Dynamics of Few-Body Systems at Ultracold Temperatures*
- Advisor: Chris H. Greene

Western Washington University, Bellingham, Washington

M.S., Mathematics: Sept. 2002–Dec. 2003

B.S., Physics and Mathematics: Sept. 1998–June 2002

Teaching Experience

Western Washington University
Assistant Professor **Sept. 2012–Present**

Courses Taught	quarters taught
Physics 101: Physics Analysis	Fall 2014
Physics 114: Principles Of Physics I	Fall 2012, Fall 2013, Fall 2014
Physics 116: Principles of Physics III	Spring 2014
Physics 162: Physics with Calculus II	Winter 2014
Physics 368: Electromagnetism I	Winter 2013, Winter 2014
Physics 369: Electromagnetism II	Spring 2013, Spring 2014

Mathematics Teaching Assistant **Aug. 2002–Aug. 2003**

University of Colorado
Graduate Teaching Assistant **Aug. 2004–Dec. 2004 and Jan. 2009–May 2009**

Course Descriptions

Fall 2012
Physics 114: Principles of Physics I, number of students: 105
This course is the first in the algebra based introductory physics sequence covering topics such as Newton's laws, kinematics, momentum, and energy.
Winter 2013
Physics 368: Electromagnetism I, number of students: 32
This course is the first in the junior level electricity and magnetism series covering electro- and maneto-statics, and introduction to Maxwell's equations.
Spring 2013, Physics 369: Electromagnetism II, number of students: 28
This course is the second in the junior level electricity and magnetism series covering electro- and maneto-dynamics, light and optics, and relativistic E&M.
Fall 2013
Physics 114: Principles of Physics I, number of students: 102
This course is the first in the algebra based introductory physics sequence covering topics such as Newton's laws, kinematics, momentum, and energy.
Winter 2014
Physics 368: Electromagnetism I, number of students: 32
This course is the first in the junior level electricity and magnetism series covering electro- and maneto-statics, and introduction to Maxwell's equations.
Physics 162: Physics with Calculus II: number of students 60
This is the second in the introductory calculus based physics series covering topics in electricity and magnetism.
Spring 2014, Physics 369: Electromagnetism II, number of students: 28
This course is the second in the junior level electricity and magnetism series covering electro- and maneto-dynamics, light and optics, and relativistic E&M.
Physics 116: Principles of Physics III, number of students 98
This is the third course in the introductory algebra based sequence covering waves and optics and select topics in modern physics.
Fall 2014
Physics 114: Principles of Physics I, number of students: 105
This course is the first in the algebra based introductory physics sequence covering topics such as Newton's laws, kinematics, momentum, and energy.
Physics 101: Physics Analysis, number of students 60
This is a physics course for non-science majors designed to introduce scientific reasoning and observation, and to introduce physics concepts and thinking to students who otherwise might not have the opportunity to learn the subject.

Research Interest and Highlights

My primary area of research is theoretical atomic, molecular and optical physics. Specifically I am interested in the areas of ultracold quantum gases, Rydberg molecules and Rydberg matter, few-body scattering and dynamics, and quantum transport. Currently my research group consists of undergraduate physics majors at Western Washington University working on three separate topics: (1) Transport and scattering in lattice systems with impurities, (2) Universal few-body systems, and (3) Collective dynamics of ultracold, confined molecular gases. I also maintain active collaborations with a number of groups from different institutions including the Harvard-Smithsonian Center for Astrophysics, the US Naval Academy, and Oklahoma University. In collaboration with researchers from six other universities, two national labs, and several companies from

the private sector, I am involved (in the pre-proposal phase) with the creation of The Institute for Applied Quantum Sciences an NSF Science and Technology Center to a research and education pipeline focussed on moving quantum mechanics based technologies from academic research to marketable technology, and to educate students at the undergraduate and graduate level so they are ready to move directly into this field.

Below is a short description of some highlights from my scholarly work to date

(2011–2014) Predicted the onset of a new type of instability in Bose-Einstein condensates of polar molecules that emerges due to the emergence of negative dielectric behavior. Current experiments are on the verge of testing these predictions (with R. Wilson, B. M. Peden and J. L. Bohn)

(2010-2012) Predicted the emergence of an anomalous permanent dipole moment in homonuclear Rydberg molecules (with H. R. Sadeghpour) that confirmed the experimental measurements of T. Pfau *et al.* in 2011. Further predicted an associated series of blue detuned molecular states in Cs_2 Rydberg molecules which have dipole moments in excess of 10 Debye and were observed by J. Shaffer et al. in 2012 at Univ. of Oklahoma.

(2008–2012) Developed a suite of techniques and prediction on the behavior of three-body collisions in externally applied fields including the first prediction of the three-body recombination rates of aligned polar molecules (with C. Ticknor), the first prediction of three-body radio frequency association rates (with T. Tscherbul) and a simple prediction of the broadening of three-body resonances due to a changing magnetic field which was in excellent agreement with experiments from S. Jochim *et al.* in Heidelberg and K. O'Hara *et al.* at Penn. Sate.

Funding

Date	Agency	Title		Funding
6/2015–6/2017	Research Corporation	Transport and disorder in simple lattices with overlapping impurities	PI	$40,000 +match $15,000
6/2015–6/2018	NSF-RUI	The role of microscopic molecular structure in confined Bose-Einstein condensates of diatomic molecules	PI	$188,323

Selected Significant Publications

Below is a list of several significant publications. A complete list of publications and presentations can be found below.

- "Production of trilobite Rydberg molecule dimers with thousand-Debye permanent electric dipole moments," D. Booth, **S. T. Rittenhouse**, J. Yang, H. R. Sadeghpour and J. P. Shaffer, Science **348**, 99 (2015).
- "Spin Waves and Dielectric Softening of Polar Molecule Condensates ," R. M. Wilson, B. M. Peden, C. W. Clark and **S. T. Rittenhouse**, Phys. Rev. Lett. **112**, 135301 (2014).
- "Observation of blue-shifted ultralong-range Cs_2 Rydberg molecules," J. Talant, **S. T. Rittenhouse**, D. Booth, H. R. Sadeghpour and J. Shaffer, Phys. Rev. Lett. (editor's suggetion) **109**, 173202 (2012).
- "First-order phase transitions in optical lattices with tunable three-body onsite interactions," A. Safavi-Naini, J. von Stecher, B. Capogrosso-Sansone and **S. T. Rittenhouse**, Phys. Rev. Lett. **109**, 135302 (2012).
- "A homonuclear molecule with a permanent electric dipole moment," W. Li, T. Pohl, J. M. Rost, **S. T. Rittenhouse**, H. R. Sadeghpour, J. Nipper, B. Butscher, J. B. Balewski, V. Bendkowsky, R. Löw and T. Pfau, Science **334**, 1110 (2011).
- "The hyperspherical four-fermion problem," **S. T. Rittenhouse**, J. von Stecher, J. P. D'Incao, N. P. Mehta and C. H. Greene, J. Phys. B (Topical Review) **44**, 172001 (2011).

- "Three-body recombination of dipoles to weakly bound dimers," C. Ticknor and **S. T. Rittenhouse**, Phys. Rev. Lett. (editors suggestion) **105**, 013201 (2010).
- "Ultracold giant polyatomic Rydberg molecules: Coherent control of molecular orientation,"**S. T. Rittenhouse** and H. R. Sadeghpour, Phys. Rev. Lett. **104**, 243002 (2010).
- "A General Theoretical Description of N-Body Recombination," N. P. Mehta, **S. T. Rittenhouse**, J. P. D'incao, J. von Stecher and C. H. Greene, Phys. Rev. Lett. 103, 153201 (2009).

Fellowships and Awards

- Nominated for the 2010 DAMOP thesis prize.
- Institute for Theoretical Atomic and Molecular Physics (ITAMP) Postdoctoral Fellowship (2009).
- National Research Council Fellowship, offered March 2009 (declined in favor of ITAMP).

Professional contributions and other Items of Interest

- Served on the American Physical Society Group on Few-Body Physics Nomination committee.
- Co-Organizer of ITAMP workshop titled "Finite temperature and low energy effects in cold atomic and molecular few - and many - body systems."
- Co-Organizer of the weekly topical lunch discussions and seminars at ITAMP.
- Chair of several sessions at international workshops and conferences including the APS April Meeting.
- Helped to develop and create WWU Physics and Astronomy Summer Student Research Stipend Program. The goal of this program is to provide department funds for summer research with the goal of seeding research for future funding opportunities
- Started and organized a still ongoing series of weekly AMO theory seminars at JILA.
- Rydberg molecule work was featured in Science News ("A giant proposal for a new molecule," author: Laura Sanders, Science News **178**, page 8, June 3rd, 2010).
- Four-Fermion work has been featured on the cover of Physics Today (March 2010).
- Referee for several professional journals including Physical Review Letters, Physical Review A, the Journal of Physics B, and Few-Body Systems.
- Created and held the position of Social Organizer for ITAMP.

Complete Publication List

30. "A comparative analysis of binding in ultralong-range Rydberg molecules," C. Fey, M. Kurz, P. Schmelcher, **S. T. Rittenhouse**, and H. R. Sadeghpour, N. J. Phys. **17**, 055010 (2015).
29. "Production of trilobite Rydberg molecule dimers with thousand-Debye permanent electric dipole moments," D. Booth, **S. T. Rittenhouse**, J. Yang, H. R. Sadeghpour and J. P. Shaffer, Science **348**, 99 (2015).
28. "Spin Waves and Dielectric Softening of Polar Molecule Condensates," R. M. Wilson, B. M. Peden, C. W. Clark and **S. T. Rittenhouse**, Phys. Rev. Lett. **112**, 135301 (2014).
27. "How do ultra-long-range homonuclear Rydberg molecules get their dipole moments?" H. R. Sadeghpour and **S. T. Rittenhouse**, Molecular Physics **111** 1902 (2013).
26. " Approach to form long-range ion-pair molecules in an ultracold Rb gas," A. Kirrander, **S. T. Rittenhouse**, M. Ascoli, E. E. Eyler, P. L. Gould, and H. R. Sadeghpour, Phys. Rev. A **87**, 031402(R) (2013).
25. "Non-universal bound states of two identical heavy fermions and one light particle, " A. Safavi-Naini, **S. T. Rittenhouse**, D. Blume and H. R. Sadeghpour, Phys. Rev. A **87**, 032713 (2013).
24. "Observation of blue-shifted ultralong-range Cs_2 Rydberg molecules," J. Talant, **S. T. Rittenhouse**, D. Booth, H. R. Sadeghpour and J. Shaffer, Phys. Rev. Lett. (editor's suggetion) **109**, 173202 (2012).

23. "First-order phase transitions in optical lattices with tunable three-body onsite interactions," A. Safavi-Naini, J. von Stecher, B. Capogrosso-Sansone and **S. T. Rittenhouse**, Phys. Rev. Lett. **109**, 135302 (2012).
22. "Electric field control in ultralong-range triatomic polar Rydberg molecules," M. Mayle, **S. T. Rittenhouse**, P. Schmelcher and H. R. Sadeghpour, Phys. Rev. A **85**, 052511 (2012).
21. "A dielectric superfluid of polar molecules," R. M. Wilson, **S. T. Rittenhouse** and J. L. Bohn , New J. Phys. **14**, 043018 (2012).
20. "A homonuclear molecule with a permanent electric dipole moment," W. Li, T. Pohl, J. M. Rost, **S. T. Rittenhouse**, H. R. Sadeghpour, J. Nipper, B. Butscher, J. B. Balewski, V. Bendkowsky, R. Löw and T. Pfau, Science **334**, 1110 (2011) [Authorship order is determined by institution].
19. "Rydberg atom mediated polar molecule interactions: a tool for molecular-state conditional quantum gates and individual addressability ," E. Kuznetsova, **S. T. Rittenhouse**, H. R. Sadeghpour and S. F. Yelin, Phys. Chem. Chem. Phys. **13**, 17115 (2011).
18. "Three-body RF association of Efimov trimers," T. V. Tscherbul and **S. T. Rittenhouse**, Phys. Rev. A **84**, 062706 (2011).
17. "Ultralong-range polyatomic Rydberg molecules formed by a polar perturber," **S. T. Rittenhouse**, M. Mayle, P. Schmelcher and H. R. Sadeghpour, J. Phys. B **44**, 184005 (2011).
16. "The hyperspherical four-fermion problem," **S. T. Rittenhouse**, J. von Stecher, J. P. D'Incao, N. P. Mehta and C. H. Greene, J. Phys. B (Topical Review) **44**, 172001 (2011).
15. "Green's functions and the adiabatic hyperspherical method," **S. T. Rittenhouse**, N. P. Mehta and C. H. Greene, Phy. Rev. A **82**, 022706 (2010).
14. "Three-body recombination of dipoles to weakly bound dimers," C. Ticknor and **S. T. Rittenhouse**, Phys. Rev. Lett. (editors suggestion) **105**, 013201 (2010).
13. "Ultracold giant polyatomic Rydberg molecules: Coherent control of molecular orientation,"**S. T. Rittenhouse** and H. R. Sadeghpour, Phys. Rev. Lett. **104**, 243002 (2010).
12. "Magnetic Field Dependence and Broadening in Universal Three-Body Recombination Resonances," **S. T. Rittenhouse**, Phys. Rev. A **81**, 040701(R) (2010).
11. "Hyperspherical Approach to the Four-body Problem," N. P. Mehta, **S. T. Rittenhouse**, J. P. D'Incao and C. H. Greene, Atomic Structure and Collision Processes, Editor: Man Mohan, Narosa Publishing House (2010).
10. "Collective Coordinate Description of the Degenerate Fermi Gas in an Anisotropic Trap," **S. T. Rittenhouse**, M. J. Cavagnero and C. H. Greene, J. Phys. Chem. A 113, 15016 (2009).
9. "A General Theoretical Description of N-Body Recombination," N. P. Mehta, **S. T. Rittenhouse**, J. P. D'incao, J. von Stecher and C. H. Greene, Phys. Rev. Lett. 103, 153201 (2009).
8. "Dimer-Dimer Collisions at Finite Energies in Two-Component Fermi Gases," J. P. D'Incao, **S. T. Rittenhouse**, N. P. Mehta and Chris H. Greene. Phys. Rev. A **79**, 030501 (2009).
7. "Efimov States Embedded in the Three-Body Continuum," N. P. Mehta, **S. T. Rittenhouse**, J. P. D'Incao and C. H. Greene, Phys. Rev A. **72**, 020701 (2008).
6. "Degenerate Fermi Gas with Density-dependent Interactions in the large N limit under the K Harmonic Approximation," **S. T. Rittenhouse** and C. H. Greene, J. Phys. B **41**, 205302 (2008). Selected by J. Phys. B as a highlight of 2008.
5. "Stability of Inhomogeneous Multicomponent Fermi Gases," D. Bume, **S. T. Rittenhouse**, J. von Stecher and C. H. Greene, Phys. Rev. A **77**,033627 (2008).
4. "Hyperspherical Description of the Degenerate Fermi Gas: S-wave Interactions," **S. T. Rittenhouse**, M. J. Cavagnero, J. von Stecher and C. H. Greene, Phys. Rev. A **75**, 053624 (2006).
3. "A hyperspherical variational approach to the N-body problem," **S. T. Rittenhouse**, M. J. Cavagnero, J. von Stecher and C. H. Greene, Few Body Systems **38**, 85-90 (2005).

2. "Physical Interpretation of Orthogonal Hilbert Space Transformations in Tight-Binding Systems with Nonorthogonal Bases," **S. T. Rittenhouse** and B. L. Johnson, Phys. Rev. B **71**, 035118 (2005).
1. "From Simple Rules to Cycling in Community Assembly," S. J. Schreiber and **S. T. Rittenhouse**, Oikos **105**, 349-358 (2004).

Publications in preparation

* Undergraduate research student

- "Interference minima and dark states in simple molecular wire systems," with E. Johnson* and B. M. Peden.
- "Bogoliubov theory of a two-state molecular BEC in quasi-2D with dipolar interactions," with J. Hall*, M. McLanahan*, B. M. Peden and R. M. Wilson,
- "Spectral behavior of three bosons in 2D in the presence of an external magnetic field interacting via contact interactions," with A. Wray* and B. L. Johnson

Presentations

Invited Talks

17. "The evolution of trilobite molecules," Chrisfest: AMO physics according to Chris Greene, 2015.
16. ""Ultralong-range Rydberg molecules with kilo-Debye dipole moments," 16th annual meeting of the Northwest section of the APS, 2015
15. "Trilobite states and s-wave mixing in Cs Rydberg molecules," International Workshop on Ultracold Rydberg Physics, 2014.
14. "Dipole moments in long-range Rydberg molecules," University of British Colombia Chemistry Department AMO seminar, 2014.
13. "First-order phase transition in optical lattices with tunable onsite three-body interactions." Hamburg
12. "Rydberg excitations coupled to polar molecules," Fundamental Science with Ultracold Polar Molecules topical meeting at ITAMP, 2011.
11. "Probing three-body dynamics," Few-Body Physics session at DAMOP, 2011.
10. "Few-body systems in ultracold dipolar gases," CQuIC seminar series at Univ. of New Mexico and Quantum Lunch series seminar at LANL, April 2011.
9. "Giant polyatomic Rydberg molecules," International Workshop on Ultracold Rydberg Physics, Nov. 2010.
8. "Giant polyatomic Rydberg molecules: Creating Rydberg's cat,"MPIPKS Cold Rydberg Gases and Ultracold Plasmas workshop, Sept. 2010
7. "Observing Efimov Physics in Ultracold Gases," Invited talk at Stony Brook University, Nov. 2010.
6. "Efimov Physics in Ultracold Gases," Invited LBNL Molecular and Nuclear physics talk, Dec. 2009.
5. "Semi-Classical Methods in N-Body Recombination," Efimov Physics in Molecules and Nuclei' workshop, October 2009.
4. "Signatures of Efimov Physics," ITAMP job talk, March 2009.
3. "Illuminating 3- and 4-Body Problems with Hyperspherical Coordinates," Invited talk at the Annual International Laser Physics Workshop, 2008.
2. "Efimov Physics in Multichannel Systems," Washington State University Department of Physics AMO Seminar, 2007.
1. "Hyperspherical Treatment on the N-Fermion Problem," Invited talk at the University of Kentucky Department of Physics, 2005.

Contributed Conference and Workshop Presentations

11. Talk: "Ultralong Range Cs_2 Rybderg molecules," Division of Atomic Molecular and Optical Physics APS meeting (2012).
10. Talk: "Dielectric superfluids," APS March Meeting (2012).
9. Talk:"Recombination of Three-Dipoles to weakly bound Molecules," Division of Atomic Molecular and Optical Physics APS meeting (2010).
8. Poster:"Weakly Bound Rydberg-Dipole Molecules," Division of Atomic Molecular and Optical Physics APS meeting (2010).
7. Talk: "Efimov States Embedded in the Continuum," Division of Atomic Molecular and Optical Physics APS meeting (2008).
6. Poster: "Hyperangular Green's functions and the three-body problem," Division of Atomic Molecular and Optical Physics APS meeting (2007).
5. Poster: "The Four-Body problem," Division of Atomic Molecular and Optical Physics APS meeting (2007).
4. Talk: "3-, 4- and N-Body Problems in Hyperspherical Coordinates," Cuernavaca Workshop on Quantum Dynamics of Ultracold Few-Body Systems (2007).
3. Talk: "Describing the Degenerate Fermi Gas in a Renormalized Hyperspherical Treatment," American Physical Society March meeting (2007).
2. Talk: "Hyperspherical Treatment of the N Fermion Problem," Division of Atomic Molecular and Optical Physics APS meeting (2006).
1. Talk: "A Physical Interpretation of an Orhtogonal Hilbert-Space Transformation: Transmision Antiresonances from Long-Range Hopping," American Physical Society March meeting (2005).