

# Curriculum vitae

Edward E. Eyler

## 1. PERSONAL

Born: Akron, Ohio, March 8, 1955

Address: Department of Physics  
University of Connecticut  
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## 2. EDUCATION

S.B. (Physics), June 1977, Massachusetts Institute of Technology, Cambridge, Massachusetts.

M.A. (Physics), June 1978, Harvard University, Cambridge, Massachusetts.

Ph.D. (Physics), January 1982, Harvard University.

Thesis: "Spectroscopy and Lifetime Measurements of Some  $n=3$  and  $n=4$  States of  $H_2$ ".

Advisor: Professor Francis M. Pipkin.

## 3. APPOINTMENTS

1982-1983: Post-doctoral Fellow, Harvard University.

1983-1988: Assistant Professor of Physics, Yale University.

1986-1987: Junior Faculty Fellow, Yale University (Award providing one year leave of absence at full salary.)

1988-1989: Associate Professor of Physics, Yale University.

1989-1995: Associate Professor of Physics (tenured), University of Delaware.

1995-present: Professor of Physics, University of Connecticut.

March 2007: Distinguished Visitor, JILA (University of Colorado).

2015-2016: Visiting Professor, Massachusetts Institute of Technology Department of Chemistry (sabbatical leave, Fall 2015).

## 4. HONORS, INVITED TALKS AND ACTIVITIES, 1991-PRESENT

1. Fellow of the American Physical Society since 1997.
2. Invited Speaker, "Tests of Fundamental Molecular Physics Using Multiphoton Spectroscopy of  $H_2$ ," Spring Meeting of the American Physical Society and DAMOP and DCP divisions, Washington, DC, April 1991.

3. Invited Speaker, "Physics of Weakly Bound levels near the ionization and dissociation limits of H<sub>2</sub>," European Research Conference on "Very High Resolution Spectroscopy with Photoelectrons -- ZEKE Spectroscopy," Kreuth, Germany, October 1991.
4. Invited Speaker, High-resolution spectroscopy of molecular hydrogen near the second dissociation limit," Symposium on Cold Atom Collisions, Institute for Theoretical Atomic and Molecular Physics, Cambridge, MA, April 1992.
5. Executive Committee, American Physical Society Topical Group on Fundamental Constants and Precise Tests of Physical Laws, 1991-1995. Chaired nominating committee, 1992; education committee, 1993; Francis M. Pipkin award committee, 1992-1994. Originated and acted as initial fund-raiser for the Pipkin award. Member of program committee.
6. Member, APS Pipkin award committee, 2002-2004; Chair, 2004.
7. Program Committee, also Session Chair, Conference on Quantum Electronics and Laser Science (QELS), 1992 and 1996.
8. Session Chair, session on "H<sub>2</sub> Excited States: New Perspectives from High Resolution Experiments," at DAMOP divisional meeting of the American Physical Society, Chicago, IL, May 1992.
9. Discussion Leader, Gordon Conference on Multiphoton Processes, New London, NH, June 1992.
10. Session Chair, April Meeting of the American Physical Society, Washington, DC, April 1993.
11. Session chair, DAMOP Divisional Meeting of the American Physical Society, Chicago, May 1993.
12. Invited speaker, "Extending the limits of high-resolution pulsed-laser spectroscopy," ACS Annual Meeting, San Diego, March 13-17, 1994.
13. Chair and Organizer (with R. Vessot, Harvard University), 1994 and 1995 "Physics in Action" day-long programs for undergraduate physics majors at the APS Spring Washington meeting, sponsored by the APS Topical Group on Precision Measurements and Fundamental Constants.
14. Session chair, DAMOP Divisional Meeting of the APS, Washington, April 1994.
15. Invited speaker, "Measurements of Excited states in Molecular Hydrogen to 1 part in 10<sup>8</sup>," 49th International Symposium on Molecular Spectroscopy, Columbus, OH, June 13-17, 1994.
16. Invited speaker, "Measuring the Ionization Potential of Molecular Hydrogen: Excited-state Spectroscopy at 9 parts in 10<sup>9</sup>," Gordon Conference on Molecular Electronic Spectroscopy, August 14-19, 1994.

17. Editorial board, *Physical Review A*, January 1997-December 1999. Member of review panel for *Physical Review A*, 1996-1997.
18. Invited Speaker, "FM Spectroscopy using Pulse-amplified Lasers," 53<sup>rd</sup> Symposium on Molecular Spectroscopy, Ohio State University, June 15-19, 1998.
19. Invited talk, E.E. Eyler, A.N. Nikolov, H. Wang, W.C. Stwalley, and P.L. Gould, "Formation and Detection of Ultracold Ground-state Molecules," CLEO/QELS 1999, Baltimore, May 23-28, 1999.
20. Colloquium, "Physics of Barely Bound States: Ultra-weak Molecular Bonds and Ultracold Molecules," Wesleyan University, February 11, 1999.
21. Atomic Physics Seminar, "Formation and Detection of Ultracold Molecules," SUNY Stony Brook, March 15, 1999.
22. Technical Program Committee member for Cooling and Trapping, CLEO/QELS '00, San Francisco.
23. Summer Colloquium for Undergraduate Research Students, "Making Ultracold Ground-State Molecules," University of Connecticut, June 25, 1999.
24. Invited Talk, "Efficient Production of Ultracold Ground-state  $K_2$  by Photoassociation," Workshop on Trapping, Spectroscopy, and Collisions of Ultracold Molecules," ITAMP, Harvard University, July 1-3, 1999.
25. Seminar, Yale University Physics Department, "Efficient Production of Ultracold Potassium Molecules," Sept. 30, 1999.
26. Session Chair, CLEO/QELS 2000, San Francisco, May 8-12, 2000.
27. Invited Talk and Session Chair, "A Dense Gas of Ultracold Rubidium Atoms near the Ionization Limit," DAMOP Divisional Meeting of the APS, Storrs, CT, June 13-17, 2000.
28. Invited Talk, "High-resolution studies of Rydberg dynamics in dense cold gases," Annual Meeting of the Optical Society of America, Providence, RI, Oct. 22-26, 2000.
29. Invited talk, "Spectroscopy and ionization dynamics of a dense gas of ultracold Rydberg atoms," ITAMP workshop on Complex Phenomena Involving Rydberg Atoms and Molecules, Cambridge, MA, April 26-28, 2001.
30. Session Chair (twice), CLEO/QELS 2001, Baltimore, MD, May 6-11, 2001.
31. Session Chair, International Conference on Laser Spectroscopy, Snowbird, UT, June 10-15, 2001.
32. Program Committee and Session Chair, CLEO/QELS 2002, Long Beach, CA, May 19-23, 2002.

33. Session Chair, DAMOP 2002, Williamsburg, VA, May 29-June 1, 2002.
34. Invited talk, "Cold Atom Rydberg-Rydberg Interactions, Excitation Blockades, and Quantum Information," International Workshop on Rydberg Atoms, Dresden, May 3-9, 2004.
35. Atomic Physics Seminar, "Measuring the Dissociation Energies of Molecular Hydrogen and Its Ion," University of Connecticut, Physics Department, March 21, 2005.
36. Seminar, "Cold Atom Rydberg-Rydberg Interactions, Excitation Blockades, and Quantum Information," JILA (University of Colorado), July 20, 2005.
37. Invited talk, "Long-range interactions and molecular resonances in ultracold Rydberg gases," Cold and Ultracold Plasma and Rydberg Physics Workshop, ITAMP, Harvard University, Sept. 26, 2005.
38. Invited talk, "Photoassociative Formation, Spectroscopic Detection, and Magnetic Trapping of Ultracold KRb Molecules," Frontiers in Optics/Laser Science conference, Tucson, AZ, Oct. 19, 2005.
39. Invited talk, "Formation, Trapping, and State-Specific Detection of Ultracold Polar KRb Molecules," Physics of Quantum Electronics conference, Snowbird, UT, January 3, 2006.
40. Session Chair, DAMOP 2008, State College, PA, May 27-31, 2008.
41. Invited talk, "Interactions and dynamics of ultracold Rydberg Rb," Workshop on Cold Rydberg Gases and Ultracold Plasmas (CRYP10), Dresden, Germany, September 6-10, 2010.
42. Session Chair, DAMOP 2011, Atlanta, GA, June 14-17, 2011.
43. Invited talk (given by graduate student Drew Chieda), "Rapid Deceleration of Atoms and Molecules by Optical Bichromatic Forces," Atomic, Molecular, and Optical Physics Seminar, SUNY Stony Brook, May 16, 2010.
44. Invited talk, "Investigating Rydberg-Rydberg and ion-pair interactions by excitation of an ultracold gas of Rb atoms," 22<sup>nd</sup> Colloquium on High Resolution Molecular Spectroscopy (DIJON 2011), Dijon, France, August 29-Sept. 2, 2011.
45. Invited talk, "Investigating Long-range Rydberg and Ion-pair Interactions in an Ultracold Gas of Rydberg Atoms," ITAMP workshop on Heavy Rydberg Physics, Harvard-Smithsonian Center for Astrophysics, May 11-12, 2012.
46. Colloquium, "An optical sledgehammer: Rapid deceleration of atoms and (maybe) molecules with optical bichromatic forces," University of Nevada at Reno, October 5, 2012.
47. Colloquium, "New Techniques for the Formation and Spectroscopy of Ultracold Molecules," Wesleyan University, Nov. 8, 2012.

48. Seminar, "New Techniques for the Formation and Spectroscopy of Ultracold Molecules," Delaware State University Optical Sciences Center for Applied Research (OSCAR), Nov. 20, 2012.
49. Seminar, "An optical sledgehammer: Rapid deceleration of atoms and (maybe) molecules with optical bichromatic forces," University of Waterloo (Canada), May 17, 2013.
50. External thesis examiner for the Ph.D. defense of Jeffrey D. Carter, University of Waterloo Department of Physics, May 17, 2013.
51. External Ph.D. thesis examiner for Parvendra Kumar, IIT Guwahati, August 2013.
52. Talk, "Laser Spectroscopy of Molecular Rydberg States: A 35-year retrospective," MIT Symposium on Molecular Structure and Dynamics (in Honor of Robert W. Field's 71<sup>st</sup> Birthday), MIT, June 13, 2015.

## 5. RECENT CONTRIBUTED TALKS, ARTICLES, AND POSTERS

1. Poster, "Suppression of Rydberg excitation in an ultracold atomic sample," D. Tong, S.M. Farooqi, J. Stanojevic, S. Krishnan, Y.P. Zhang, R. Côté, E.E. Eyler, and P.L. Gould, ITAMP/UConn Open House, Storrs, CT, February 5, 2005.
2. Poster, "State-Selective Detection and Trapping of Ultracold High- $\nu$  Ground-state Rb<sub>2</sub>, and Spectroscopy of the (2) <sup>1</sup>S<sub>u</sub><sup>+</sup> state," Y. Huang, J. Qi, H. Kim, E.E. Eyler, P.L. Gould, and W.C. Stwalley, ITAMP/UConn Open House, Storrs, CT, February 5, 2005.
3. Talk, "State-selective detection of ultracold KRb molecules in near-dissociation vibrational levels," D. Wang, E.E. Eyler, P.L. Gould, and W.C. Stwalley, DAMOP 2005, Lincoln, NE, May 17-21, 2005.
4. Poster, "State-Selective Detection of Ultracold High- $\nu$  Ground-State Rb, and Spectroscopy of the (2) <sup>1</sup>Σ<sub>u</sub><sup>+</sup> State," Y. Huang, H. Kim, J. Qi, D. Wang, E.E. Eyler, P.L. Gould, and W.C. Stwalley, DAMOP 2005, Lincoln, NE, May 17-21, 2005.
5. Poster, "Molecular Resonances due to Long-Range Interactions between Ultracold Rydberg Atoms," D. Tong, S.M. Farooqi, J. Stanojevic, R. Côté, E.E. Eyler, and P.L. Gould, DAMOP 2005, Lincoln, NE, May 17-21, 2005.
6. Poster, "Formation, Detection and Trapping of Photoassociated Ultracold KRb Molecules," QELS 2005 Technical Digest, Optical Society of America. Meeting held May 23-27, Baltimore, MD.
7. Talk, "State-Selective Detection of Ultracold Rubidium Molecules in High Vibrational Levels of the X <sup>1</sup>Σ<sub>g</sub><sup>+</sup> Ground State," QELS 2005 Technical Digest, Optical Society of America. Meeting held May 23-27, Baltimore, MD.

8. Poster, "State-Selective Detection and Spectroscopy of Ultracold Rb<sub>2</sub> and KRb Molecules," E.E. Eyler, Y. Huang, D. Wang, H. Kim, P.L. Gould, and W.C. Stwalley, 17<sup>th</sup> International Conference on Laser Spectroscopy, June 19-24, 2005, Aviemore, Scotland.
9. Poster, "Measuring the Dissociation Energies of H<sub>2</sub>, D<sub>2</sub>, HD, and their Ions," E.E. Eyler, Y. Huang, E.E. Eyler, Y.P. Zhang, J. Stanojevic, and C.H. Cheng, 17<sup>th</sup> International Conference on Laser Spectroscopy, June 19-24, 2005, Aviemore, Scotland.
10. Four contributed talks and four contributed posters, various projects, DAMOP 2006, Knoxville, TN, May 16-20, 2006.
11. Talk, "Electric Quadrupole Transitions and Anomalous Fine Structure Ratios in Rydberg <sup>85</sup>Rb," P.L. Gould, D. Tong, S.M. Farooqi, E.G.M. van Kempen, and E.E. Eyler, ICAP 2006, Innsbruck, Austria, July. 16-21, 2006.
12. Talk, "Production, Detection and Spectroscopy of Ultracold KRb and Rb<sub>2</sub> Molecules," D. Wang, C. Ashbaugh, Y. Huang, H.K. Pechkis, J.T. Kim, E.E. Eyler, P.L. Gould, and W.C. Stwalley, ICAP 2006, Innsbruck, Austria, July. 16-21, 2006.
13. Talk, "Direct Frequency Comb Spectroscopy in Helium: Proposed Schemes and Progress," D. Procyk, E.E. Eyler, M. Stowe, J.J. Jones, K. Moll, M. Thorpe, and J. Ye, ICAP 2006, Innsbruck, Austria, July. 16-21, 2006.
14. Poster, "Toward Direct Frequency Comb Spectroscopy in Helium: Proposed Measurements and Experimental Progress," D.E. Procyk, M. Bellos, E.E. Eyler, M.C. Stowe, R.J. Jones, K.D. Moll, M.J. Thorpe, and J. Ye, FiO/LS 2006, Rochester, NY, Oct. 8-12, 2006.
15. Talk, "Electric Quadrupole Transitions to Rydberg States and Anomalous Fine Structure Ratios in Ultracold <sup>85</sup>Rb," David Tong, S.M. Farooqi, E.G.M. van Kempen, E.E. Eyler, and P.L. Gould, FiO/LS 2006, Rochester, NY, Oct. 8-12, 2006.
16. Talk, "Rotationally-Resolved Depletion Spectroscopy of Ultracold KRb Molecules," Dajun Wang, Court Ashbaugh, Jin-Tae Kim, Edward E. Eyler, Phillip L. Gould, and William C. Stwalley, FiO/LS 2006, Rochester, NY, Oct. 8-12, 2006.
17. Invited talk by co-author D. Wang: "Production, Detection, Spectroscopy and Collisions of Ultracold KRb Molecules," D. Wang, C. Ashbaugh, Y. Huang, H.K. Pechkis, J.T. Kim, E.E. Eyler, P.L. Gould, and William C. Stwalley, FiO/LS 2006, Rochester, NY, Oct. 8-12, 2006.
18. Talk: "State-Selective Detection of Ultracold Rb<sub>2</sub> and Optical Trapping Using a CO<sub>2</sub> Laser," H.K. Pechkis, Y. Huang, D. Wang, C. Ashbaugh, E.E. Eyler, P.L. Gould, and W.C. Stwalley, FiO/LS 2006, Rochester, NY, Oct. 8-12, 2006.
19. One contributed talk and one contributed posters, DAMOP 2007, Calgary, AB, June 5-9, 2007.
20. Talk: "Phase-stabilized Femtosecond Frequency Combs: a 21st Century Revolution in Optical Frequency Measurements," seminar for UConn Society of Physics students, Nov. 28, 2007.

21. Talk, "Formation, Detection, and Spectroscopy of Ultracold Ground-State KRb," D. Wang, J.-T. Kim, E. E. Eyler, P. L. Gould, and W. C. Stwalley, Ohio State Symposium on Molecular Spectroscopy, Columbus OH, June 18-22, 2007.
22. Talk, "Resonance-enhanced Photoassociative Formation of Ground-state Rb<sub>2</sub> and Spectroscopy of Mixed-character Excited States," H. K. Pechkis, D. Wang, Y. Huang, E. E. Eyler, P. L. Gould, W. C. Stwalley, and C. P. Koch, Ohio State Symposium on Molecular Spectroscopy, Columbus OH, June 18-22, 2007.
23. Poster, "High-Resolution Depletion Spectroscopy of Ultracold Ground-state KRb," E.E. Eyler, D. Wang, J.T. Kim, P.L. Gould, and W.C. Stwalley, Gordon Research Conference on Atomic Physics, Tilton, NH, July 1-6, 2007.
24. Poster, "Prospects for Precision Measurements of Atomic Helium Using Direct Frequency Comb Spectroscopy," Drew E. Chieda, Edward E. Eyler, Matthew C. Stowe, Michael J. Thorpe, Thomas R. Schibli, and Jun Ye, Gordon Research Conference on Atomic Physics, Tilton, NH, July 1-6, 2007.
25. Poster, "Prospects for Precision Measurements of Atomic Helium Using Direct Frequency Comb Spectroscopy," Drew E. Chieda, Edward E. Eyler, Matthew C. Stowe, Michael J. Thorpe, Thomas R. Schibli, and Jun Ye, Connecticut-Cambridge AMO Physics Workshop, Harvard University, April 12, 2008.
26. Poster, "Progress towards forming ultracold <sup>85</sup>Rb<sub>2</sub> molecules in an optical trap," H.K. Pechkis, M. Bellos, J. RayMajumder, R. Carollo, E.E. Eyler, P.L. Gould, and W.C. Stwalley,, Connecticut-Cambridge AMO Physics Workshop, Harvard University, April 12, 2008.
27. Poster, "Progress towards forming ultracold <sup>85</sup>Rb<sub>2</sub> molecules in an optical trap," H.K. Pechkis, M. Bellos, J. RayMajumder, R. Carollo, E.E. Eyler, P.L. Gould, and W.C. Stwalley, DAMOP 2008 conference, State College PA, May 27-31, 2008.
28. Poster, "A high-power, Fourier-transform limited light source for precision spectroscopy in the XUV," K.G.H. Baldwin, Mitsuhiro Kono, Richard T. White, Yabai He, Brian J. Orr, and E.E. Eyler, International Conference on Atomic Physics (ICAP 2008), Storrs CT, July 27-Aug. 1, 2008,
29. Poster, "Progress on a Helium Slower for MOT Loading using the Bichromatic Force," D.E. Chieda, Bryan Conway, Nicholas Destefano, and E.E. Eyler, ICAP 2008, Storrs CT, July 27-Aug. 1, 2008,
30. Poster, "Progress Towards Forming Ultracold <sup>85</sup>Rb<sub>2</sub> Molecules in an Optical Dipole Trap," H.K. Pechkis, M. Bellos, R. Carollo, J. Ray Majumder, E.E. Eyler, P.L. Gould, and W.C. Stwalley, ICAP 2008, Storrs CT, July 27-Aug. 1, 2008.
31. Poster, "Excitation of the 5p-8p Electric Quadrupole Transition in Cold Rb Atoms," Rico Pires, Marco Ascoli, Edward Eyler, and Philip Gould, DAMOP 2009, Charlottesville VA, May 20-23, 2009.
32. Poster, "Excitation Resonant Coupling in the Heteronuclear Alkali Dimers for Direct Photoassociative Formation of X <sup>1</sup>Σ<sup>+</sup> v''=0 Ultracold Molecules," J. RayMajumder, M. Bellos, R.

Carollo, M. Recore, M. Mastroianni, W.C. Stwalley, E.E. Eyler, and P.L. Gould, DAMOP 2009, Charlottesville VA, May 20-23, 2009.

33. Poster, "Resonant Coupling in the Heteronuclear Alkali Dimers for Direct Photoassociative Formation of X(0,0) Ultracold Molecules," Faraday Discussion 142, Durham, UK, April 15-17, 2009.

34. Poster, "Progress towards forming ultracold  $^{85}\text{Rb}_2$  and  $^{39}\text{K}^{85}\text{Rb}$  molecules in an optical dipole trap," Faraday Discussion 142, Durham, UK, April 15-17, 2009.

35. Poster, "Resonant Coupling in the Heteronuclear Alkali Dimers for Direct Photoassociative Formation of Ground-state Ultracold Molecules," J. RayMajumder, M. Bellos, R. Carollo, M. Recore, M. Mastroianni, W.C. Stwalley, E.E. Eyler, and P.L. Gould, Colorado Cold Molecule Workshop, July 15-17, 2009.

36. Poster, "Formation of ultracold  $\text{Rb}_2$  in the ground  $X^1\Sigma_g^+$  state in an optical dipole trap," H.K. Pechkis, R. Carollo, M. Bellos, J. Banerjee, E.E. Eyler, P.L. Gould, and W.C. Stwalley, DAMOP 2010, Houston TX, May 26-29, 2010.

37. Poster, "Versatile single-chip event sequencer for atomic physics experiments," E.E. Eyler, DAMOP 2010, Houston TX, May 26-29, 2010.

38. Poster, "Negative Ions from Ultracold Rydberg Atoms," M. Ascoli, L. Aldridge, D.M. Karpov, D. Rahmlow, E.E. Eyler, and P.L. Gould, DAMOP 2010, Houston TX, May 26-29, 2010.

39. Poster, "Formation and collisional dynamics of ultracold  $\text{Rb}_2$  in the ground  $X^1\Sigma_g^+$  state in an optical dipole trap," H. K. Pechkis, R. Carollo, M. Bellos, J. Banerjee, D. Rahmlow, E. E. Eyler, P. L. Gould, and W. C. Stwalley, ICAP 2010, Cairns, AU, July 2530, 2010.

40. Poster, "Spectroscopic analysis of the  $1^1\Pi$ ,  $2^3\Sigma^+$ , and  $1^3\Pi$  states of the  $^{39}\text{K}^{85}\text{Rb}$  diatomic molecule using molecular beam and ultracold photoassociation experiments," J. T. Kim, Y. Lee, D. Wang, B. Kim, E. E. Eyler, P. L. Gould, and W. C. Stwalley, ICAP 2010, Cairns, AU, July 2530, 2010.

41. Poster, "Progress towards Direct Photoassociative Formation of Ultracold  $\text{KRb}$  Molecules in the lowest rovibronic state  $X^1\Sigma^+$ ,  $v=0$ ,  $N=0$ ," J. Banerjee, D. Rahmlow, R. Carollo, M.A. Bellos, E.E. Eyler, P.L. Gould, and W.C. Stwalley, DAMOP 2011, Atlanta, GA, May 14-17, 2011.

42. Talk, "Blue-detuned photoassociation in  $\text{Rb}_2$ ," M.A. Bellos, D. Rahmlow, R. Carollo, J. Banerjee, E.E. Eyler, P.L. Gould, and W.C. Stwalley, DAMOP 2011, Atlanta, GA, May 14-17, 2011.

43. Poster, "Spectroscopic Determination of Optimal Pathways for Vibrational Transfer in Ultracold  $\text{KRb}$  Molecules," J.T. Kim, Y. Lee, B. Kim, D. Wang, W.C. Stwalley, P.L. Gould, and E.E. Eyler, DAMOP 2011, Atlanta, GA, May 14-17, 2011.

44. Poster, "Bichromatic Force Slowing of Helium Over Large Velocity Ranges," M.A. Chieda and E.E. Eyler, DAMOP 2011, Atlanta, GA, May 14-17, 2011.



45. Talk, "Blue-Detuned Photoassociation Spectrum In  $\text{Rb}_2$ ," M. A. Bellos, D. Rahmlow, R. Carollo, J. Banerjee, E. E. Eyler, P. L. Gould, and W. C. Stwalley, 66<sup>th</sup> International Symposium on Molecular Spectroscopy, Columbus, OH, June 20-24, 2011.
46. Talk, Analysis Of Strongly Perturbed  $1^1\Pi - 2^3\Sigma^+ - B^3\Pi$  States Of The  $\text{KRb}$  Molecule," J.T. Kim, Y. Lee, B. Kim, D. Wang, W.C. Stwalley, P.L. Gould, and E.E. Eyler, 66<sup>th</sup> International Symposium on Molecular Spectroscopy, Columbus, OH, June 20-24, 2011.
47. Talk, Prospects For Rapid Deceleration Of Diatomic Molecules With Optical Bichromatic Forces," E.E. Eyler and M.A. Chieda, 66<sup>th</sup> International Symposium on Molecular Spectroscopy, Columbus, OH, June 20-24, 2011.
48. Poster, "Prospects for rapid deceleration of diatomic molecules with optical bichromatic forces," E. E. Eyler and M. A. Chieda, 22<sup>nd</sup> Colloquium on High Resolution Molecular Spectroscopy (DIJON 2011), Dijon, France, August 29-Sept. 2, 2011.
49. Poster, "Analysis of the strongly perturbed  $1^1\Pi - 2^3\Sigma^+ - b^3\Pi$  states of  $\text{KRb}$  and identification of optimal STIRAP transfer paths," J. T. Kim, Y. Lee, B. Kim, D. Wang, W. C. Stwalley, P. L. Gould, and E. E. Eyler, 22<sup>nd</sup> Colloquium on High Resolution Molecular Spectroscopy (DIJON 2011), Dijon, France, August 29-Sept. 2, 2011.
50. Poster, "Powerful low-cost laser lab instrumentation using 32-bit microcontrollers and an Android tablet interface," E. E. Eyler, DAMOP 2012, Orange County, CA, June 4-8, 2012.
51. Poster, "Advances in Bichromatic Force Slowing of Atoms and Molecules," M. A. Chieda and E. E. Eyler, DAMOP 2012, Orange County, CA, June 4-8, 2012.
52. Talk, "Spectroscopy of  $^{39}\text{K}^{85}\text{Rb}$  electronic states in the predicted region of resonantly coupled excited states for the direct formation of the  $X(0,0)$  state," J. Banerjee, D. Rahmlow, R. Carollo, M. A. Bellos, M. Bermudez, E. E. Eyler, P. L. Gould, and W. C. Stwalley, DAMOP 2012, Orange County, CA, June 4-8, 2012.
53. Poster, "Observation of Blue-Detuned Photoassociation to the  $2(0_g^+)$  State of  $^{85}\text{Rb}_2$  via REMPI," M. A. Bellos, R. Carollo, D. Rahmlow, J. Banerjee, M. Bermudez, E. E. Eyler, P. L. Gould, and W. C. Stwalley, DAMOP 2012, Orange County, CA, June 4-8, 2012.
54. Poster, "Spectroscopic investigation of the  $A$  and  $3^1\Sigma^+$  states of  $^{39}\text{K}^{85}\text{Rb}$ ," J. T. Kim, Yonghoo Lee, Bongsoo Kim, Dajun Wang, Phillip Gould, Edward Eyler, and William Stwalley, DAMOP 2012, Orange County, CA, June 4-8, 2012.
55. Poster, "Spectroscopy of ultracold polar  $^{39}\text{K}^{85}\text{Rb}$  molecules and its applications", J. Banerjee, D. Rahmlow, R. Carollo, M.A. Bellos, E.E. Eyler, P.L. Gould, and W.C. Stwalley, ACS National Meeting, Philadelphia, PA, August 19-23, 2012.
56. Talk, "Progress toward Slowing and Cooling of  $\text{CaF}$  with Optical Bichromatic Forces", Edward E. Eyler and Michael A. Chieda, 67<sup>th</sup> OSU International Symposium on Molecular Spectroscopy, Columbus, OH, June 18-22, 2012.

57. Talk, "Observation of Blue-detuned Photoassociation to the  $2(0_g^+)$  state of  $^{85}\text{Rb}_2$  via REMPI," M.A. Bellos, R. Carollo, D. Rahmlow, J. Banerjee, M. Bermudez, E.E. Eyler, P.L. Gould, and W.C. Stwalley, 67<sup>th</sup> OSU International Symposium on Molecular Spectroscopy, Columbus, OH, June 18-22, 2012.
58. Talk, "Spectroscopic Analysis of the  $A$  and  $3^1\Sigma^+$  States of  $^{39}\text{K}^{85}\text{Rb}$ ," Jin-Tae Kim, Yonghoon Lee, Bongsoo Kim, Dajun Wang, Phillip L. Gould, Edward E. Eyler, and William C. Stwalley, 67<sup>th</sup> OSU International Symposium on Molecular Spectroscopy, Columbus, OH, June 18-22, 2012.
59. Poster, "Spectroscopic Investigation of the  $A^1\Sigma^+$ ,  $3^1\Sigma^+$ ,  $1^1\Pi$ ,  $2^3\Sigma^+$ , and  $b^3\Pi$  States of  $^{39}\text{K}^{85}\text{Rb}$  and Optimal STIRAP Transfer Paths," Jin-Tae Kim, Yonghoon Lee, Bongsoo Kim, Dajun Wang, Phillip L. Gould, Edward E. Eyler, and William C. Stwalley, 23<sup>rd</sup> International Conference on Atomic Physics (ICAP), Palaiseau, France, July 23-27, 2012.
60. Poster, "Rapid Slowing of Atoms and Molecules using Optical Bichromatic Forces" E. E. Eyler and M. A. Chieda, 23<sup>rd</sup> International Conference on Atomic Physics (ICAP), Palaiseau, France, July 23-27, 2012.
61. Talk, "Efficient Slowing of Atomic and Molecular Beams using Optical Bichromatic Forces", E.E. Eyler and M.A. Chieda, FiO/LS (Optical Society of America), Rochester, NY, October 14-18, 2012.
62. Talk, "Resonant Coupling and Spectroscopy of Different Excited States of Ultracold KRb Molecules", J. Banerjee, D. Rahmlow, R. Carollo, M.A. Bellos, E.E. Eyler, P.L. Gould, and W.C. Stwalley, FiO/LS (Optical Society of America), Rochester, NY, October 14-18, 2012.
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64. Poster, "Instrumentation for diode laser spectroscopy using 32-bit microcontrollers and a Nexus 7 Android tablet," Edward Eyler, DAMOP 2013, Quebec City, Quebec, June 3-7, 2013.
65. Talk, "Observation and Analysis of Resonant Coupling Between Near-Degenerate Levels of the  $2^1\Sigma_g^+$  and  $1^1\Pi_g$  States of Ultracold  $^{85}\text{Rb}_2$ ," R. Carollo, M.A. Bellos, D. Rahmlow, J. Banerjee, E.E. Eyler, P. L. Gould, and W.C. Stwalley, DAMOP 2013, Quebec City, Quebec, June 3-7, 2013.
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## **7. CURRENT RESEARCH ACTIVITIES**

### **1. Precision measurements in atomic helium, including ultracold helium**

In collaboration with Kenneth Baldwin and co-workers at ANU, we are continuing a long-term program to measure the 1s-2s interval. Our earlier 1997-1999 measurement, a collaboration with NIST and with Prof. Baldwin, was accurate to about 1 part in  $10^8$ , and will be improved by a factor of about 10 in a planned series of improvements using long-pulse nanosecond laser systems.

At the same time, we are taking a completely new approach to measuring other key portions of the helium spectrum. In collaboration with Jun Ye at JILA, NIST, and the University of Colorado, we hope to measure UV spectra by direct use of a phase-stabilized femtosecond frequency comb. In support of this new effort, a novel two-stage bichromatic force slower is nearing completion. It will be used to load ultracold helium into a MOT.

### **2. Bichromatic-force slowing and cooling of CaF molecules**

In the latest new venture, we are applying the rectified optical force from a counterpropagating pair of bichromatic lasers to deflect and slow a molecular system, CaF. The bichromatic force offers much larger decelerations than the ordinary radiative force during the limited number of optical cycles available before molecules are lost by radiative decay into an inaccessible "dark" state.

### **3. Ultracold Rydberg gases**

In conjunction with the groups of Phillip Gould and Robin Côté, are investigating the physics of ultracold dense gases of Rydberg rubidium atoms and ultracold plasmas. Some of our principal findings include: (1) Observation and explanation of a molecular resonance near the atomic 5s-70p transition, (2) Studies of ionization and recombination dynamics, including spontaneous formation of cold plasmas, (3) Evidence for suppressed excitation, or “blockading,” due to strong long-range atomic interactions due to dispersion forces.

### **4. Ultracold Molecules**

In collaboration with the groups of William Stwalley and Philip Gould, we have developed and successfully tested methods to produce and study translationally ultracold molecules. We can now prepare and detect large numbers of Rb<sub>2</sub> or KRb molecules in the ground *X* state. An extensive program of spectroscopy, trapping, and dynamical studies is in progress. The newest result, tying in closely with our interest in Ultracold Rydberg atoms, is the successful excitation of ultracold Rb<sub>2</sub> molecules directly into “trilobite-type” states, in which a ground-state Rb atom is bound within the wavefunction of a Rydberg *np* atom, where *n* ranges from 7–12.

### **5. Near-threshold dissociation and the dissociation energies of H<sub>2</sub>, D<sub>2</sub> and HD**

After a decade-long of effort, we completed in 2004 our studies molecular hydrogen. In our final experiments, particular, we probed the second dissociation limit of molecular hydrogen with very high resolution, while selectively detecting final-state 2*s* or 2*p* atoms. Both the highest bound vibrational levels and the adjoining continuum have been studied with a resolution of about 0.01-0.02 cm<sup>-1</sup>, which we believe is the highest resolution so far attained for any molecular photodissociation continuum. Three principal types of information are obtained in these experiments: the level structure of the highest bound levels, the dissociation energy of molecular hydrogen, and the details of the structure of the near-threshold continuum, including atomic branching ratios. In prior work, we also completed accurate determinations of the ionization energy of H<sub>2</sub> and its isotopologues.

## **8. TEACHING; ADDITIONAL INFORMATION**

Extensive teaching experience includes involvement in at least fifteen different courses, including both laboratory and lecture courses, at both the undergraduate and graduate levels. These include various courses in introductory physics, electricity and magnetism for upper-level undergraduates, waves, optics, atomic physics for graduate and undergraduate students, and laboratory courses in computer interfacing, atomic spectroscopy, and optics. I have particularly enjoyed teaching laboratory and lecture courses directed towards undergraduate juniors and seniors, and have had the pleasure of receiving consistently favorable course evaluation ratings from students in these courses. In 1990-1993 I developed a new optics laboratory sequence as part of the Physics 313 optics course I taught at Delaware. In 2001-2006 I developed many new laboratories for the electronics course (Physics 256) and advanced undergraduate laboratory (Physics 258/259) at the University of Connecticut. More recently I have been extensively refurbishing the teaching laboratory for the optics course (Physics 4150), as well as adapting some of the experiments for use in our course on lasers (Physics 4140). I have been quite active externally, attending several professional conferences each year and also typically presenting about 4-5 seminars and colloquia. Detailed information on teaching experience and conference activities is available upon request.