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Education

June 2002

Ph.D. in Physical Chemistry, University of Chicago

“Highly-Sensitive and Efficient Infrared Spectroscopy of Molecular Ions” Advisor: Takeshi Oka

June 1997

M.S. in Physical Chemistry, University of Chicago

May 1996

B.S. in Chemistry, Minor in Applied Mathematics, University of Akron

Research

2002–present

Postdoctoral Research Associate, R.E. Miller Group, Dept. of Chemistry, University of North Carolina-Chapel Hill

- Relaxation dynamics of molecules in helium nanodroplets. Vibrational and rotational dynamics of ethylene in helium droplets. Discovery of a mechanism for the vibrational relaxation of diatomic molecules in helium droplets. Design and construction of a mass spectrometer based helium nanodroplet apparatus. Automation of cw-optical parametric oscillator infrared spectrometer.
- Chemistry at ultra-low temperatures. Measurement and analysis of the ionization and charge-transfer mechanisms of doped helium nanodroplets. Spectroscopy and *ab initio* studies of the chemistry between germanium and silicon atoms and small hydrocarbon molecules. Development of the optically selective mass spectrometry technique. Design and construction of a high-temperature evaporation oven for helium droplet doping.
- Helium nanodroplet assisted thin film deposition. Design and construction of thin film deposition device for temperature programmed desorption (TPD) studies. Synthesis of novel metal-organic molecule clusters. Development of a new soft-landing deposition technique.

1996–2002

Research Assistant, T. Oka Group, Dept. of Chemistry and the Enrico Fermi Institute, University of Chicago

- Design and construction of high-resolution, high-sensitivity absorption spectroscopy equipment for the study of molecular ions. Computer automation of a color center laser. Implementation of opto-mechanical servo-locking loops. Setup, operation, and maintenance of a krypton ion laser and a high resolution Fourier transform infrared spectrometer. Development of sensitivity improving techniques including auto-balanced subtraction, velocity modulation, and infrared phase modulation with heterodyne detection. Improvements in molecular glow discharges. Construction of supersonic plasma slit jet.
- High-resolution, high-sensitivity spectroscopy of molecular ions. Measurement of the H_3^+ destruction rate limited by ambipolar diffusion in a positive column discharge. Survey of H_3^+ absorption transitions from 3000–4200 cm^{-1} . Compilation and evaluation of H_3^+ spectroscopy. Evaluation of theoretical calculations of H_3^+ using experimentally determined energy levels. Chemistry and spectroscopy of positive column discharges containing C, H, N, and He.

Research (continued)

- High-resolution spectroscopy of doped solid hydrogen. Ion-H₂ cluster formation in the condensed phase upon γ -ray irradiation. Tone-burst modulation spectroscopy of water and ortho-hydrogen induced infrared activity in para-hydrogen crystals.

1995–1996

Research Assistant, D. S. Perry Group, Dept. of Chemistry, University of Akron

- Analysis of the 3 μ m jet-cooled high-resolution spectrum of CH₃NH₂. Assignment of the torsional-inversion C-H stretch spectrum of methylamine. Development of spectral analysis tools using Igor Pro.

Expertise

Superfluid helium nanodroplets, temperature programmed desorption, soft-landing cluster deposition molecular beams, UHV and high-vacuum systems, tunable lasers, analog and digital electronics, absorption spectroscopy, ion-molecule chemistry, molecular discharges, spectral data analysis, computer automation, solid hydrogen, opto-mechanical servo loops, quantum mechanics, matrix isolation spectroscopy, cryogenic instrumentation.

Honors and Awards

- 2002 Nathan Sugarman Award for excellence in graduate student research (Enrico Fermi Inst., Univ. of Chicago)
- 2002 Elizabeth R. Norton Prize for excellence in research in chemistry (Dept. of Chem., Univ. of Chicago)
- 2001 Freud Departmental Citizenship Award (Dept. of Chemistry, Univ. of Chicago)
- 1997 Nathan Sugarman Teaching Award in General Chemistry (Univ. of Chicago, Dept. of Chem.)
- 1996 Graduated magna cum laude (Univ. of Akron)
- 1995 ACS Outstanding Junior Award in Chemistry (Akron Section ACS)
- 1995 Lubrizol Chemistry Scholarship (Univ. of Akron)

Teaching Experience

- 2003 *Lecturer*, Dept. of Chemistry, Univ. of North Carolina-Chapel Hill
Undergraduate General Chemistry (16 weeks, 175 students)
- 2002 *Substitute Lecturer*, Dept. of Chemistry, Univ. of North Carolina-Chapel Hill
Undergraduate Physical Chemistry (3 weeks, 20 students)
- 2001 *Teaching Assistant*, Dept. of Chemistry, Univ. of Chicago
Undergraduate General Chemistry (11 weeks, 20 students)
- 1998 *Teaching Assistant*, Dept. of Chemistry, Univ. of Chicago
Graduate Wave Mechanics (11 weeks, 10 students)
- 1996–1997 *Teaching Assistant*, Dept. of Chemistry, Univ. of Chicago
Undergraduate General Chemistry (33 weeks, 20 students)
- 1993–1994 *Undergraduate Tutor*, Dept. of Developmental Programs, Univ. of Akron
Chemistry

Service

- 2003 Rao prize judge, Ohio State Univ. International Symposium on Molecular Spectroscopy
- 2000–2002 Student web committee (developed and maintained the Univ. of Chicago, Dept. of Chemistry web pages, <http://chemistry.uchicago.edu>)
- 1998–1999 Student Ombudsman for the Dept. of Chemistry (Univ. of Chicago)
- 1997–2001 Prospective graduate student host
- 1997–1998 Student representative on the Chemistry Faculty Teaching Committee (Univ. of Chicago)
- 1994–1995 Vice-president, American Chemical Society-Student Affiliates at the Univ. of Akron

Professional Societies

American Chemical Society

References

Takeshi Oka	Takamasa Momose	David Perry	Roger Miller
University of Chicago	Kyoto University	University of Akron	Univ. of N.C.-Chapel Hill
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Publications

- C. M. Lindsay** and R. E. Miller, “Reaction of Ge and Si with HCN in helium nanodroplets”, in preparation.
- W. K. Lewis, **C. M. Lindsay**, and R. E. Miller, “Optically selective mass spectrometry and the charge transfer process in doped helium droplets”, in preparation.
- C. M. Lindsay** and R. E. Miller, “Rotational and vibrational dynamics of ethylene in helium nanodroplets”, in preparation.
- C. M. Lindsay**, W. K. Lewis, and R. E. Miller, “Confirmation of the metastability of HF ($v = 1$) in helium nanodroplets”, *J. Chem. Phys.*, in press.
- C. M. Lindsay**, T. Oka, and T. Momose, “A remeasurement of the 2.4 μm orthohydrogen induced spectrum in solid parahydrogen”, *J. Mol. Spectrosc.*, 218,131–133 (2003).
- B. J. McCall, A. J. Huneycutt, R. J. Saykally, **C. M. Lindsay**, T. Oka, M. Fushitani, Y. Miyamoto, and T. Momose, “Stimulated Stokes downconversion in liquid and solid parahydrogen”, *Appl. Phys. Lett.*, 82,1350–1352 (2003).
- C. M. Lindsay** and B. J. McCall, “Comprehensive evaluation and compilation of H_3^+ spectroscopy”, *J. Mol. Spectrosc.*, 210, 60–68 (2001).
- C. M. Lindsay**, R. Rade, Jr., and T. Oka, “Survey of H_3^+ between 3000–4200 cm^{-1} ”, *J. Mol. Spectrosc.* 210, 51–59 (2001).
- T. Momose, **C. M. Lindsay**, Y. Zhang, and T. Oka, “Sharp spectral lines observed in γ -ray ionized para-hydrogen crystals”, *Phys. Rev. Lett.*, 86, 4795–4798 (2001).
- C. M. Lindsay**, E. T. White, and T. Oka, “Measurement of the H_3^+ destruction rate due to ambipolar diffusion in an AC positive column discharge”, *Chem. Phys. Lett.*, 328, 129–134 (2000).

Presentations

- C. M. Lindsay**, “Liquid helium droplets: 0.4 Kelvin nanoscale test tubes”, American Chemical Society National Meeting, Philadelphia, Pennsylvania, Aug 22, 2004. (invited talk)
- C. M. Lindsay**, ““Chemistry near absolute zero: probing doped liquid helium nanodroplets with infrared spectroscopy”, Eglin Air Force Base, Aug 17, 2004. (invited talk)
- C. M. Lindsay**, “Chemistry near absolute zero: probing doped liquid helium nanodroplets with infrared spectroscopy”, Gordon Research Conference on Atomic and Molecular Interactions, Colby-Sawyer College, New London, New Hampshire, July 11-16, 2004. (invited talk)

- C. M. Lindsay**, W. K. Lewis, and R. E. Miller, "The C-H stretch spectrum of ethylene in liquid helium droplets", *Jewels in Spectroscopy*, University of Chicago, Chicago, Illinois, June 21, 2003. (poster)
- C. M. Lindsay**, W. K. Lewis, and R. E. Miller, "The C-H stretch spectrum of ethylene in liquid helium droplets", 58th Ohio State University International Symposium on Molecular Spectroscopy, Columbus, Ohio, June 16-20, 2003. (talk)
- C. M. Lindsay**, W. K. Lewis, and R. E. Miller, "Spectroscopic determination of charge transfer probabilities in doped helium droplets", 58th Ohio State University International Symposium on Molecular Spectroscopy, Columbus, Ohio, June 16-20, 2003. (talk)
- C. M. Lindsay**, T. Oka, and T. Momose, "Further studies on sharp transitions induced in solid parahydrogen by methane", 57th Ohio State University International Symposium on Molecular Spectroscopy, Columbus, Ohio, June 17-21, 2002. (talk)
- C. M. Lindsay**, T. Oka, and T. Momose, "Spectroscopy of highly excited HCNH^+ using infrared heterodyne velocity modulation", 57th Ohio State University International Symposium on Molecular Spectroscopy, Columbus, Ohio, June 17-21, 2002. (talk)
- C. M. Lindsay**, C. F. Neese, and T. Oka, "Infrared laser absorption spectroscopy with heterodyne detection", 57th Ohio State University International Symposium on Molecular Spectroscopy, Columbus, Ohio, June 17-21, 2002. (talk)
- T. Oka, Y. Zhang, **C. M. Lindsay**, and T. Momose, "Ultrahigh resolution spectroscopy of frozen van der Waals molecules in parahydrogen crystals", 57th Ohio State University International Symposium on Molecular Spectroscopy, Columbus, Ohio, June 17-21, 2002. (talk)
- C. M. Lindsay**, C. F. Neese, and T. Oka, "Infrared heterodyne spectroscopy," Society for Applied Spectroscopy Meeting, Evanston, IL, Oct. 16, 2001. (poster)
- C. M. Lindsay** and B. J. McCall, "Compilation and evaluation of the laboratory spectroscopy of H_3^+ ," 222nd American Chemical Society National Meeting, Chicago, IL, Aug 26-30, 2001. (poster)
- C. M. Lindsay**, T. Oka, and T. Momose, "Observation of new sharp transitions in para-hydrogen crystals doped with methane." 56th Ohio State University International Symposium on Molecular Spectroscopy, Columbus, Ohio, June 10-15, 2001. (talk)
- C. M. Lindsay** and B. J. McCall, "Compilation and evaluation of the laboratory spectroscopy of H_3^+ ," 56th Ohio State University International Symposium on Molecular Spectroscopy, Columbus, Ohio, June 10-15, 2001. (talk)
- C. M. Lindsay** and C. F. Neese, "Miscellaneous Igor Pro and Excel add-ins for spectroscopic analysis," 56th Ohio State University International Symposium on Molecular Spectroscopy, Columbus, Ohio, June 10-15, 2001. (talk)
- C. M. Lindsay**, R. M. Rade, Jr., and T. Oka, "Survey of H_3^+ transitions between 3000 and 4200 cm^{-1} ," 55th Ohio State University International Symposium on Molecular Spectroscopy, Columbus, Ohio, June 11-16, 2000. (talk)
- T. Momose, **C. M. Lindsay**, Y. Zhang, and T. Oka, "High-resolution IR spectroscopy of H_2 in ion clusters produced by γ -ray irradiation in parahydrogen crystals," 55th Ohio State University International Symposium on Molecular Spectroscopy, Columbus, Ohio, June 11-16, 2000. (talk)
- C. M. Lindsay**, R. M. Rade, Jr., and T. Oka, "Survey of H_3^+ transitions between 3000 and 4200 cm^{-1} ," The Royal Society Discussion Meeting on Astronomy, Physics and Chemistry of H_3^+ , London, February 9-10, 2000. (poster)

- C. M. Lindsay**, E. T. White, and T. Oka, "Measurement of the H_3^+ destruction rate due to ambipolar diffusion in an AC positive column discharge," The Royal Society Discussion Meeting on Astronomy, Physics and Chemistry of H_3^+ , London, February 9-10, 2000. (poster)
- C. M. Lindsay**, E. T. White, T. Oka, "Measurement of the H_3^+ destruction rate due to ambipolar diffusion in an AC positive column discharge," 54th Ohio State University International Symposium on Molecular Spectroscopy, Columbus, Ohio, June 14-18, 1999. (talk)
- A. Chirokolava, **C. M. Lindsay**, T. Cronin, X. Wang, and D. S. Perry, "Infrared spectrum of methylamine in the asymmetric C-H stretch region," 51st Ohio State University International Symposium on Molecular Spectroscopy, Columbus, Ohio, June 10-14, 1996. (talk)