John M. Doyle

Curriculum Vitae, Refereed Publications, and Additional Information

Lyman Laboratory of Physics
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Education:

Massachusetts Institute of Technology
Ph.D., Condensed Matter and Atomic Physics, 1991. Thesis: Energy Distribution Measurements of Magnetically Trapped Spin-Polarized Hydrogen: Evaporative Cooling and Surface Sticking. IBM Thomas J. Watson Fellowship. Advisor: T.J. Greytak

International School of America
One Term of Study, 1985
On site study of religion and ethnicity in Asia.

Massachusetts Institute of Technology
B.S., Electrical Engineering, 1986
Thesis: Vibrationally Excited H_2 in a Non-Equilibrium Population.

Positions:

Harvard University, Cambridge, MA — 2015–present
Henry B. Silsbee Professor of Physics

Harvard University, Cambridge, MA — 1999–present
Professor of Physics

Okayama University, Okayama, Japan — 2019–present
Visiting Professor

Harvard University, Cambridge, MA — 1997–1999
John L. Loeb Associate Professor of the Natural Sciences

Harvard University, Cambridge, MA — 1993–1997
Assistant Professor of Physics

Massachusetts Institute of Technology, Cambridge, MA — 1991–1993
Postdoctoral Associate

AT&T Bell Laboratories, Murray Hill, NJ — 1988
Research Assistant

Massachusetts Institute of Technology, Cambridge, MA — 1984–1985
Teaching Assistant

Wellesley College, Wellesley, MA — 1984
Instructor, Project Exploration

Angenics, Inc., Cambridge, MA — 1983-84
Engineering Consultant, Engineer

Raytheon, Inc., Manchester, NH — 1982
Engineering Assistant

Research Interests:

Research is performed in Atomic, Molecular and Optical physics and Elementary Particle physics. Current work centers around production, trapping, and use of cold and ultra-cold molecules in a variety of experiments including studies of quantum information systems, collisions, quantum gases, optical spectroscopy, and searches for time-reversal violating, beyond the Standard Model physics.

Students, Education, and Collaborations:

Supervised the Ph.D. degrees of thirty one students and seventeen postdocs, with career paths into academia, industry, and national labs. Taught graduate and undergraduate classes in in several subjects, including Quantum Mechanics. Taught several Freshman Seminars and co-developed the courses *Widely Applied Physics* (applications of physics to the real world, for physics majors) and *Science & Engineering for Managing COVID*. Performed research at MIT, Harvard and NIST Center for Neutron Research. Collaborative work (past and current) with researchers at Caltech, JILA, MIT, Northwestern University, University of Arizona, University of California Los Angeles, University of Chicago, and Yale.

Service, Fellowships, Prizes:

Founding co-director of the Center for Ultracold Atoms, a National Science Foundation Physics Frontier Center, (2000-2020)
Founding co-director of the Harvard Quantum Initiative, (2018-)
Founding co-director of the Ph.D. Program in Quantum Science and Engineering (2021-)
Founding director of the Harvard Quantum Optics Center, (2010-2017)
Co-Founder of N95decon.org (2020)
APS Broida Prize (2021)
Humboldt Fellow (2006-)
Fulbright Fellow (2010-2011)
Japanese Society for the Promotion of Science Fellow (2010-)

American Physical Society
Fellow (2002-)
Topical Group on Precision Measurement and Fundamental Constants (GPMFC), Chair line (2014-17)
Public Face of Physics member (1999)
POPA member (1999-2002)
GPMFC Nominating Committee member (2001 and 2021)
Visited Congress as Representative of the APS (2016)
DAMOP Program Committee (2016, 2017)
DAMOP APS Fellows Committee (2018-2020)
DNP 2021 Meeting Local Organizing Committee
DAMOP Nominating Committee (2019-)
Pipkin Award Committee (vice chair 2020-21, chair 2022-23)
Broida Award Committee (2022-)

Organized or on program committee of more than twenty workshops, conferences and schools, including Gordon Conferences, DAMOP, Ultracold Molecules, Precision Measurement with Slow Neutrons, US-Japan Seminar on Coherent Quantum Systems and others.

Selected additional service at home institution, Harvard University:

Japan-US Undergraduate Research Exchange Program (JUREP), Founder and Director (2006-)
Japan Undergraduate Summer Science Research Program steering committee, founding member (2017-)
Member of the Full Faculty Committee of the Reischauer Institute of Japanese Studies (2006-)
University Faculty Council (1998-2000)
Standing Committee on Ph.D. in Chemical Physics (2002-)

Standing Committee on Higher Degrees in Quantum Science and Engineering (2021-)
Facilities committees (e.g. machine shop, electronics shop, safety, radiation)
FAS Covid Return to Scholarship Committee (2020-21)
Covid Research Planning Group (2020-21)
Community Mask Project Committee (2020)
FAS/SEAS Covid Laboratory Oversight and Compliance Committee(CLOCC) (2020-21)
Covid Mask Committee (2020-21)
Covid UVC Committee (2021-22)

Refereed Publications:

[1] *Spin-polarized Hydrogen Maser*, H.F. Hess, G.P Kochanski, J.M. Doyle, T.J. Greytak, D. Kleppner, *Phys Rev. A* **34**, 1602 (1986).

[2] *Magnetic Trapping of Spin-polarized Atomic Hydrogen*, H.F. Hess, G.P. Kochanski, J.M. Doyle, N. Masuhara, D. Kleppner, T.J. Greytak, *Phys. Rev. Lett.* **59**, 935 (1987).

[3] *Evaporative Cooling of Spin-polarized Atomic Hydrogen*, N. Masuhara, J.M. Doyle, J.C. Sandberg, D. Kleppner, T.J. Greytak, G.P. Kochanski, and H.F. Hess, *Phys. Rev. Lett.* **61**, 935 (1988)

[4] *Energy Distributions of Trapped Atomic Hydrogen*, J.M. Doyle, J.C. Sandberg, N. Masuhara, I.A. Yu, D. Kleppner, and T.J. Greytak, *J. Opt. Soc. Am. B***6**, 2244 (1989)

[5] *Hydrogen in the Submillikelvin Regime: Sticking Probability on Superfluid* ^4He, J.M. Doyle, J.C. Sandberg, I.A. Yu, C. Cesar, D. Kleppner, and T.J. Greytak, *Phys. Rev. Lett.* **67**, 603 (1991).

[6] *Evidence for Universal Quantum Reflection of Hydrogen from Liquid* ^4He, I.A. Yu, J.M. Doyle, J.C. Sandberg, C. Cesar, D. Kleppner, and T.J. Greytak, *Phys. Rev. Lett.* **71**, 1589 (1993).

[7] *Evaporative Cooling of Atomic Hydrogen: Theory of Cooling and Progress Towards the Bose-Einstein Transition*, J.M. Doyle, J.C. Sandberg, I.A. Yu, C.L. Cesar, D. Kleppner and T.J. Greytak, *Physica B* **194**, 13 (1994).

[8] *Surface Reflection of Submillikelvin Atomic Hydrogen from Thin Superfluid* ^4He *Films: Substrate Effects*, I.A. Yu, J.M. Doyle, J.C. Sandberg, C.L. Cesar, D. Kleppner and T.J. Greytak, *Physica B* **194-196** (1994).

[9] *Quantum Reflection of Submilikelvin Atomic Hydrogen from Bulk Superfluid* ^4He, I.A. Yu, J.M. Doyle, J.C. Sandberg, C.L. Cesar, D. Kleppner and T.J. Greytak, *Physica B* **194**, 15, (1994).

[10] *On Measuring the Neutron Beta-Decay Lifetime using Ultracold Neutrons Produced and Stored in a Superfluid-*^{4}*He-Filled Magnetic Trap*, J.M. Doyle and S.K. Lamoreaux, *Europhysics Letters* **26**, 253 (1994).

[11] *Buffer-gas loading of atoms and molecules into a magnetic trap*, J.M. Doyle, B. Friedrich, J. Kim and D. Patterson *Physical Review A* **52**, R2515 (1995).

[12] *Scattering lengths for collisions of ground-state and metastable state hydrogen atoms*, M.J. Jamieson, A. Dalgarno and J.M. Doyle, *Molecular Physics* **87**, 817 (1996).

[13] *Two-photon Spectroscopy of Trapped Atomic Hydrogen*, C. L. Cesar, D.G. Fried, T.C. Killian, A.D. Polcyn, J.C. Sandberg, I.A. Yu, T.J. Greytak, D. Kleppner and J.M. Doyle, *Physical Review Letters* **77**, 255 (1996).

[14] *Bose-Einstein Condensation*, J.M. Doyle, *Proc. Nat. Acad. Sci.* **94**, 2774 (1997).

[15] *Buffer-gas Loading and Magnetic Trapping of Atomic Europium*, J. Kim, B. Friedrich, D. Katz, D. Patterson, J. Weinstein, R. DeCarvalho and J.M. Doyle, *Physical Review Letters* **78**, 3665-8 (1997).

[16] *Fluorescence Efficiencies of Thin Scintillating Films in the Extreme Ultraviolet*, D.N. McKinsey, C.R. Brome, J.S. Butterworth, R. Golub, K. Habicht, P.R. Huffman, S.K. Lamoreaux, C.E.H. Mattoni, and J.M. Doyle, *Nuclear Instrumentation and Methods B* **132** 541-63 (1997).

[17] *Magnetic Trapping of Atomic Chromium*, J. Weinstein, R. DeCarvalho, J. Kim, D. Patterson, B. Friedrich, and J.M. Doyle, *Physical Review A* **57** R3173-5 (1998).

[18] *Towards magnetic trapping of molecules*, B. Friedrich, R. deCarvalho, J. Kim, D. Patterson, J.D. Weinstein, and J.M Doyle, J. Chem. Soc., Faraday Trans. **94** 1783-91 (1998).

[19] *Spectroscopy of buffer-gas cooled vanadium monoxide in a magnetic trapping field*, J. Weinstein, R. DeCarvalho, K. Amar, A. Boca, B.C. Odom, B. Friedrich, and J.M. Doyle, *Journal of Chemical Physics* **109** 2656-61 (1998).

[20] *Magnetic Trapping of Calcium Monohydride Molecules at Millikelvin Temperatures*, J.D. Weinstein, R. deCarvalho, T. Guillet, B. Friedrich, and J.M. Doyle, *Nature* **395** 148-50 (1998).

[21] *A Demountable Cryogenic Feedthrough for Plastic Optical Fibers*, J.S. Butterworth, C.R. Brome, P.R. Huffman, C.E.H. Mattoni, D.N. McKinsey, and J.M. Doyle, *Review of Scientific Instruments* **69** 3697-8 (1998).

[22] *A Removable Cryogenic Window for Transmission of Light and Neutrons*, J.S. Butterworth, C.R. Brome, P.R. Huffman, C.E.H. Mattoni, D.N. McKinsey, and J.M. Doyle, *Review of Scientific Instruments* **69** 3998-9 (1998).

[23] *Radiative Decay of the Metastable He_2 ($a\,^3\Sigma_u^+$) Molecule in Liquid Helium*, D.N. McKinsey, S. Dzhosyuk, C.R. Brome, J.S. Butterworth, R. Golub, K. Habicht, P.R. Huffman, S.K. Lamoreaux, C.E.H. Mattoni, and J.M. Doyle, *Physical Review A* **59** 200-4 (1999).

[24] *Zeeman Spectroscopy of CaH Molecules in a Magnetic Trap*, B. Friedrich, J.D. Weinstein, R. deCarvalho, J.M. Doyle, *Journal of Chemical Physics* **110** 2376 (1999).

[25] *Buffer-gas Loaded Magnetic Traps for Atoms and Molecules: A Primer*, R. deCarvalho, J.M. Doyle, B. Friedrich, T. Guillet, J. Kim, D. Patterson, J. Weinstein, *Eu. J. Phys. E* **7** 289 (1999).

[26] Progress Towards Magnetic Trapping of Ultracold Neutrons, P. R. Huffman, C. R. Brome, J. S. Butterworth, K. J. Coakley, M. S. Dewey, S. N. Dzhosyuk, D. M. Gilliam, R. Golub, G. L. Greene, K. Habicht, G. L. Jones, S. K. Lamoreaux, C. E. H. Mattoni, D. N. McKinsey, F. E. Wietfeldt, and J. M. Doyle. *Nuclear Instruments and Methods A* **440**, 522 (2000).

[27] *Liquid Helium and Liquid Neon - Sensitive, Low Background Scintillation Media for the Detection of Low Energy Neutrinos*, D.N. McKinsey, J.M. Doyle, *Journal of Low Temperature Physics* **118** 153 (2000) .

[28] *Magnetic Trapping of Neutrons*, P.R. Huffman, C.R. Brome, J.S. Butterworth, K.J. Coakley, M.S. Dewey, S.N. Dzhosyuk, R. Golub, G.L. Greene, K. Habicht, S.K. Lamoreaux, C.E.H. Matooni, D.N. McKinsey, F.E. Wietfeldt, J.M. Doyle, *Nature* **403** 62 (2000).

[29] *Simulation of the hyperfine-resolved Zeeman spectrum of Eu atoms in a magnetic trap*, L. Cai, B. Friedrich, J.M. Doyle, *Physical Review A* **61** 2974 (2000).

[30] *Spectroscopy of laser-ablated buffer-gas cooled PbO at 4 K and the prospects for measuring the electric dipole moment of the electron*, D. Egorov, J.D. Weinsteing, D. Patterson, B. Friedrich, and J.M. Doyle, *Physical Review A* **63** 030501(R) (2001).

[31] *Magnetically Stabilized Luminescent Excitations in Hexagonal Boron Nitride*, J.S. Butterworth, C.R. Brome, S.N. Dzhosyuk, R. Golub, P.R. Huffman, S.K. Lamoreaux, C.E.H. Matooni, D.N. McKinsey, F.E. Wietfeldt, J.M. Doyle, *Journal of Luminescence* **92/4** 291 (2001).

[32] *Magnetic Trapping of Ultracold Neutrons*, P.R. Huffman, C.R. Brome, J.S. Butterworth, K.J. Coakley, M.S. Dewey, S.N. Dzhosyuk, R. Golub, G.L. Greene, K. Habicht, S.K. Lamoreaux, C.E.H. Matooni, D.N. McKinsey, F.E. Wietfeldt, J.M. Doyle, *Physical Review C* **63** 055502-1/15 (2001).

[33] *No-sticking effect and quantum reflection in ultracold collisions*, Areez Mody, Eric Heller, and J.M. Doyle, *Physical Review B* **64** 085418-1/15 (2001).

[34] *Evaporative Cooling of Atomic Chromium*, J.D. Weinstein, R. deCarvalho, C. Hancox, J.M. Doyle, *Physical Review A* **65** 021604(R)-1/4 (2002).

[35] *Alpha and beta particle induced scintillations in liquid and solid neon*, R. Michniak, D. McKinsey, R. Alleamue, and J.M. Doyle, *NIM A* **482** 394-401 (2002).

[36] *Buffer-gas cooling of atomic and molecular beams*, D. Egorov, T. Lahaye, W. Schoellkopf, B. Friedrich, J.M. Doyle, Physical Review A **66** 043401 (2002).

[37] *Enhanced Inelastic Scattering Rates of Cold Atomic Chromium*, R. deCarvalho, C. Hancox, M. Hummon, J.M. Doyle, JOSA B**20** (2003).

[38] *Performance of a large area avalanche photodiode at low temperature*, L. Yang, S.N. Dzhosyuk, J.M. Gabrielse, C.E.H. Mattoni, S.E. Maxwell, D.N. McKinsey, J.M. Doyle, NIM A**508** 388 (2003).

[39] *Time dependence of liquid-helium fluorescence*, D.N. McKinsey, C.R. Brome, S.N. Dzhosyuk, R. Golub, K. Habicht, P.R. Huffman, E. Korobkina, S.K. Lamoreaux, C.E.H. Mattoni, A.K. Thompson, L. Yang, J.M. Doyle, PRA **67** 062716 (2003).

[40] *Detecting Ionizing Radiation in Liquid Helium using Wavelength Shifting Light Collection*, D.N. McKinsey, C.R. Brome, J.S. Butterworth, S.N. Dzhosyuk, R. Golub, K. Habicht, P.R. Huffman, C.E.H. Mattoni, L. Yang and J.M. Doyle, NIM A **516** 475 (2003).

[41] *A Long Wavelength Neutron Monochrometer for Superthermal Production of Ultracold Neutrons*, C.E.H. Mattoni, C.P. Adams, K.J. Alvine, J.M. Doyle, S.N. Dzhosyuk, R. Golub, E. Korobkina, D.N. McKinsey, A.K. Thompson, L. Yang, H. Zabel and P.R. Huffman, Physica B **344** 343-357 (2003).

[42] *The production of nitrogen-13 by neutron capture in boron compounds*, M.H. Schleier-Smith, L.D. van Buuren, J.M. Doyle, S.N. Dzhosyuk, D.M. Gilliam, C.E.H. Mattoni, D.N. McKinsey, L. Yang and P.R. Huffman, NIM B 215 531-536 (2004).

[43] *Deep Superconducting Magnetic Trap for Neutral Atoms*, J.G.E. Harris, W.C. Campbell, D. Egorov, S.E. Maxwell, R.A. Michniak, S.V. Nguyen, L.D. van Buuren, W. Ketterle, J.M. Doyle, Review of Scientific Instruments **75** 14 (2004).

[44] *Magnetic Trapping of the rare-earth atoms at millikelvin temperatrues*, C.I. Hancox, S.C. Doret, M.T. Hummon, L. Luo, J.M. Doyle, Nature**431** 281 (2004).

[45] *Neutron-induced Luminescence and Activation in Neutron Shielding and Scintillation Detection Materials at Cryogenic Temperatures*, S.N. Dzhosyuk, C.E.H. Mattoni, D.N. McKinsey, A.K. Thompson, L. Yang, J.M. Doyle and P.R. Huffman , NIM B **217** 457 (2004).

[46] *Buffer gas cooling and trapping of atoms with small effective magnetic moments*, J.G.E. Harris, R.A. Michniak, S.V. Nguyen, N. Brahms, W. Ketterle, J.M. Doyle, Europhysics Letters **67** 198 (2004).

[47] *Evaporative cooling at low trap depth*, R. deCarvalho, J.M. Doyle, Physical Review A **70** 053409 (2004).

[48] *Buffer-gas cooling of NH via the beam loaded buffer-gas method*, D. Egorov, W.C. Campbell, B. Friedrich, S.E. Maxwell, E. Tsikata, L.D. van Buuren, J.M. Doyle, European Journal of Physics D **31** 307 (2004)

[49] *Zeeman Effect in CaF*, R.V. Krems, D. Egorov, J.S. Helton, K. Maussang, S.V. Nguyen, J.M. Doyle, Journal of Chemical Physics **121** 11639 (2004)

[50] *Suppression of angular momentum transfer in cold collisions of non-S-state transition metal atoms*, C.I. Hancox, S.C. Doret, M. Hummon, R. Krems, J.M. Doyle, Physical Review Letters **94** 013201 (2004).

[51] *Evaporative cooling of magnetically trapped atomic molybdenum*, C.I. Hancox, M.T. Hummon, S.V. Nguyen, J.M. Doyle, Physical Review A **71** 031402 (2004)

[52] *Zeeman Relaxation of CaF in Low-Temperature Collisions with Helium*, K. Maussang, D. Egorov, J.S. Helton, S.V. Nguyen, J.M. Doyle, Physical Review Letters **94** 123002 (2004)

[53] *Magnetic trapping of an atomic Mn-Cr mixture*, S.V. Nguyen, J.S. Helton, K. Maussang, W. Ketterle, J.M. Doyle, Physical Review A **71** 0256602 (2005)

[54] *High-flux beam source for cold, slow atoms or molecules*, S.E. Maxwell, N. Brahms, R. deCarvalho, D. Glenn, J. Helton, D. Kielpinski, S. Nguyen, J. Petricka, D. DeMille, J.M. Doyle, Physical Review Letters **95** 173201 (2005)

[55] *Chaotic Scattering of Marginally Trapped Neutrons*, K.J. Coakley, J.M. Doyle, S.N. Dzhosyuk, L. Yang, and P.R. Huffman, Journal of Research of the National Institute of Standards and Technology **110** 367 (2005)

[56] *Evaporation of Metastable Helium in the Multi-partial-wave Regime*, S. Nguyen, S. Charles Doret, C. Connolly, R. Michniak, W. Ketterle, J.M. Doyle, Physical Review A **92** 060703(R) (2005)

[57] *A new path to ultracold hydrogen*, R. deCarvalho, N. Brahms, B. Newman, J.M. Doyle, D. Kleppner, and T. Greytak, Can. J. Phys. **83** 293 (2005)

[58] *Hybrid Quantum Processors: Molecular Ensembles as Quantum Memory for Solid State Circuits*, R. Rabl, D. DeMille, J.M. Doyle, M.D. Lukin, R.J. Schoelkopf, and P. Zoller, Physical Review Letters **97** 033003 (2006)

[59] *A coherent all-electrical interface between polar molecules and mesoscopic superconducting resonators*, A. Andre, D. DeMille, J. M. Doyle, M. D. Lukin, S. E. Maxwell, P. Rabl, R. J. Schoelkopf and P. Zoller, Nature Physics **97** 636 (2006)

[60] *A Bright, Guided Molecular Beam With Hydrodynamic Enhancement*, D. Patterson and J.M. Doyle, Journal of Chemical Physics **126** 154307 (2007)

[61] *Magnetic trapping and Zeeman relaxation of NH ($X^3\Sigma^-$)*, W.C. Campbell, E. Tsikata, Hsin-I Lu, J.M. Doyle, Physical Review Letters **98** 213001 (2007)

[62] *Spin-exchange collisions of submerged shell atoms below 1 Kelvin*, S.V. Nguyen, J.G.E. Harris, S.C. Doret, J. Helton, J.M. Doyle, Physical Review Letters **99** 223201 (2007)

[63] *Analysis of cold 52 Cr elastic and inelastic collision rates using evaporative cooling*, S.V. Nguyen, R. deCarvalho, J.M. Doyle, Physical Review A **75** 062706 (2007)

[64] *Development of High-field Superconducting Ioffe Magnetic Traps*, L. Yang, C. R. Brome, J. S. Butterworth, S. N. Dzhosyuk, C. E. H. Mattoni, D. N. McKinsey, R. A. Michniak, J. M. Doyle, R. Golub, E. Korobkina, C. M. O???fShaughnessy, G. R. Palmquist, P.-N. Seo, P. R. Huffman, K. J. Coakley , H. P. Mumm, A. K. Thompson, G. L. Yang, S. K. Lamoreaux, Rev. Sci. Inst. **79** 031301 (2008)

[65] *Vibrational Relaxation in Trapped NH*, W.C. Campbell, G.C. Groenenboom, H. Lu, E. Tsikata, J.M. Doyle, Physical Review Letters **100** 083003 (2008)

[66] *Inelastic Collisions in Optically Trapped Ultracold Metastable Ytterbium*, A. Yamaguchi, S. Uetake, D. Hashimoto, J. M. Doyle, Y. Takahashi, Physical Review Letters **101** 233002 (2008)

[67] *Magnetic trapping of atomic nitrogen and cotrapping of NH*, M.T. Hummon, W.C. Campbell, H-I. Lu, Y. Wang, and J.M. Doyle, Physical Review A **78** 050702 (2008)

[68] *Spin-orbit interaction and large inelastic rates in bismuth-helium collisions*, S.E. Maxwell, M.T. Hummon, Y. Wang, A.A. Buchachenko, R.V. Krems and J.M. Doyle, Physical Review A **78** 042706 (2008)

[69] *Magnetic Trapping of Silver and Copper, and Anomalous Spin Relaxation in the Ag-He System*, N. Brahms, B. Newman, C. Johnson, T. Greytak, D. Kleppner and J.M. Doyle, Physical Review Letters **101** 103002 (2008)

[70] *Collision-induced spin depolarization of alkali metal atoms in cold ^3He gas* , T.V. Tscherbul, P. Zhang, H.R. Sadeghpour, A. Dalgarno, N. Brahms, Y.S. Au, and J.M. Doyle, Physical Review A **78** 060703(R) (2008)

[71] *Mechanism of Collisional Spin Relaxation in $^3\Sigma$ Molecules*, W.C. Campbell, T.V. Tscherbul, Hsin-I Lu, E. Tsikata, R.V. Krems, and J.M. Doyle, Physical Review Letters **102** 013003 (2009)

[72] *EIT in Buffer-gas Cooled Rb at 4 K* , T. Hong, J.M. Doyle, M. Lukin, D. Patterson, A. Zibrov and M. Prentiss, Physical Review A **79** 013806 (2009)

[73] *Why are cold molecules so hot?*, B. Friedrich and J.M. Doyle, ChemPhysChem **10** 604 (2009)

[74] *Intense Atomic and Molecular Beams via Neon Buffer gas Cooling* , D. Patterson, J. Rasmussen and J.M. Doyle, New Journal of Physics **11** 055018 (2009)

[75] *Cooling, trap loading, and beam production using a cryogenic helium buffer gas*, W.C. Campbell and J.M. Doyle, Cold Molecules: Theory, Experiment, Applications Chapter 13, CRC Press (2009)

[76] *A buffer-gas cooled Bose-Einstein condensate*, S.C. Doret, C.B. Connolly, W. Ketterle and J.M. Doyle, Physical Review Letters **103** 103005 (2009)

[77] *Large spin relaxation rates in trapped submerged-shell atoms*, C.B. Connolly, Y.S. Au, S.C. Doret, W. Ketterle and J.M. Doyle, Physical Review A **81** 010702(R) (2010)

[78] *Permeability of Noble Gases through Kapton, Butyl, Nylon and Silver Shield*, S.J. Schowalter, C.B. Connolly, and J.M. Doyle, NIM A **615** 267-271 (2010)

[79] *Search for the electric dipole moment of the electron with thorium oxide*, A.C. Vutha, W.C. Campbell, Y.V. Gurevich, N.R. Hutzler, M. Parsons, D. Patterson, E. Petrik, B. Spaun, J.M. Doyle, G. Gabrielse and D. DeMille, Journal of Physics B **43** 074007 (2010)

[80] *Zeeman relaxation of cold atomic iron and nickel in collisions with ^3He*, C. Johnson, B. Newman, N. Brahms, J.M. Doyle, D. Kleppner and T.J. Greytak, Physical Review A **81** 062706 (2010)

[81] *Cooling and Collisions of Large Gas Phase Molecules*, D. Patterson, E. Tsikita, and J.M. Doyle, PCCP **12** 9736 (2010)

[82] *Formation of van der Waals molecules in buffer gas cooled magnetic traps*, N. Brahms, T.V. Tscherbul, P. Zhang, J. Klos, H.R. Sadeghpour, A. Dalgarno, J.M. Doyle and T.G. Walker, Physical Review Letters **105** 033001 (2010)

[83] *Magnetic Trapping of NH Molecules with 20 s Lifetimes*, E. Tsikata, W.C. Campbell, M.T. Hummon, H-I. Lu, and J.M. Doyle, New Journal of Physics **12** 065028 (2010)

[84] *Cold, optically dense gases of atomic rubidium*, S. Magkiriadou, D. Patterson, T. Nicolas and J.M. Doyle, New Journal of Physics **82** 042718 (2011)

[85] *Quantum Degenerate Mixtures of Alkali and Alkaline-Earth-Like Atoms*, H. Hara, Y. Takasu, Y. Yamaoka, J.M. Doyle, and Y. Takahashi, PRL **106** 205304 (2011)

[86] *N-NH Collisions in a Magnetic Trap*, M. Hummon, T.V. Tscherbul, J. Klos, E. Tsikita, Hsin-I Lu, E. Tsikata, W.C. Campbell, A. Dalgarno, and J.M. Doyle, PRL **106** 053201 (2011)

[87] *Magnetic relaxation in dysprosium-dysprosium collisions*, B. Newman, N. Brahms, Y.S. Au, C. Johnson, J.M. Doyle, D. Kleppner and T.J. Greytak, Physical Review A **83** 012713 (2011)

[88] *Magnetic and electric dipole moments of the $^3\Delta_1$ state in ThO*, A.C. Vutha, B. Spaun, Y.V. Gurevich, N.R. Hutzler, E. Kirilov, J.M. Doyle, G. Gabrielse, D. DeMille, Physical Review A **84** 034502 (2011)

[89] *Cold heteromolecular dipolar collisions*, B.C. Sawyer, B.K. Stuhl, M. Yeo, T.V. Tscherbul, M.T. Hummon, Y. Xia, J. Klos, D. Patterson, J.M. Doyle, J. Ye, PCCP **13** 19059 (2011)

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