

ARVINDER S. SANDHU

Curriculum Vitae

Arvinder Singh Sandhu
Department of Physics
University of Arizona,
1118 E. Fourth St. (P.O. Box 210081)
Tucson AZ 85721-0081, USA.

Email: sandhu@physics.arizona.edu
Ph: (Off) +1-520-621-6786
(Lab) +1-520-626-0629
Fax: +1-520-621-4721
<http://physics.arizona.edu/~sandhu>

Chronology of Education

Ph.D. (Physics) Tata Institute of Fundamental Research, Mumbai, India, April, 2005.
Thesis title: “Ultrashort - High Intensity Laser Matter Interaction Studies”.
Advisor: Prof. G. R. Kumar

M. Sc. (Physics) Indian Institute of Technology (IIT) Kanpur, India, May 1998.

B.Sc. (Honors in Physics), G.N.D. University, Amritsar, India, April 1996.

Chronology of Employment

Fall 2007 – Present: **Assistant Professor**, Department of Physics and College of Optical Sciences, University of Arizona, Tucson, USA.

2004-2007: **Post-doctoral Research Associate (04-06)/Senior Research Associate (06-07)**, Conducted research with Profs. M. Murnane and H. Kapteyn at JILA, University of Colorado.

1998-2004: **Graduate Research Assistant**, Tata Institute of Fundamental Research, Bombay.

1999: **Teaching Assistant**, Tata Institute of Fundamental Research, Bombay, India.

1997: **Research Intern**, Tata Inst. of Fundamental Research (TIFR), Bombay, India.

Honors and Awards

2010 Excellence in Undergraduate Physics Teaching Award, Awarded by the Department of Physics, University of Arizona.

2010 NSF Career Award, by National Science Foundation, USA for investigation of Attosecond and Femtosecond Dynamics in Atoms and Molecules using XUV+IR Spectroscopy.

ARVINDER S. SANDHU

2007 Young Scientist Medal, Awarded by Indian National Science Academy, New Delhi, India, on the basis of my research work in the field of ultrafast physics.

2005 TAA- Geeta Udgaonkar Award, Awarded by TIFR for an outstanding Ph.D. thesis of the year on the basis of work done in Physical Sciences at the Institute.

2003 Sarojini Damodran International Fellowship, Tata Institute of Fundamental Research (TIFR), Mumbai, India, to enable networking and collaborative visits with international labs.

2003 University Grants Commission and 2003 Department of Science and Technology Travel Award, Both awarded by Government of India to enable young Indian scientists to participate in international conferences.

1998 Certificate of Merit for Academic Excellence, Awarded by Indian Institute of Technology (IIT), Kanpur, India, for first position in Masters Program.

1996 Gold Medal and Merit award, Awarded by Guru Nanak Dev University, Amritsar, India for topping the B.Sc. (Honors) Physics program.

Citations in News briefs and Media

2007 My research work was featured in research highlights section of Nature Photonics, in article titled “Photoionization: Probing breakups”, Nature Photonics **1**, 609 (2007).

2007 News article highlighting results published in ‘Science’ - “Probing femtosecond molecular dynamics”, Chemical and Engineering News **85**, 33 (2007).

2003 News article on x-ray generation - “X-rays from Nanoparticles: Rough times ahead”, Nature News (India), June 2003.

2002 News article on ultrahigh magnetic field measurement - “Megagauss in Picoseconds”, Nature News (India), Dec 2002.

2002 AIP Physics News Update - The ultrahigh magnetic field and electron transport work highlighted in an article by Phil Schewe, James Riordon, Ben Stein, as “Physics News Update 614” released by AIP on Nov 20, 2002.

Extramural Service

- Student Talk and Poster Session Judge, APS 4-Corners meeting, Golden CO (2009)
- Reviewer for DOE (2009-present).
- Presider, Attosecond Session – Frontiers in Optics/Laser Science, Rochester (2006)
- Referee for Journal of Optical Society of America B (2007-present)

ARVINDER S. SANDHU

- Referee for Optics Express (2006-present)
- Referee for Journal of Physics B: Atomic, Molecular & Optical Physics (2008-present)
- Referee for Journal of Applied Physics and Applied Physics Letters (2005-present)
- Referee for Review of Scientific Instruments (2010-present).

Outreach Activities

- Design of exhibit at the local Flandrau Science Center, explaining concepts of ultrafast science using analogies with Muybridge's horse pictures (2010)
- Guest Lecturer in the Tucson Area Physics Teacher Association meeting (2007).
- Optics demonstration for middle school students, Excel Academy Charter School, Arvada (2006).
- Organized lab tours visiting students and high school students in Tucson, AZ (2007-2010).

Publications

- 1) Niranjana Shivaram, Lei Xu, Adam Roberts, and **Arvinder Sandhu**, "In-Situ Spatial Mapping of Gouy Phase Slip for High-Detail Attosecond Pump-Probe Measurements" (**Submitted to Optics Letters**)
- 2) Adam Roberts, Niranjana Shivaram, Lei Xu and **Arvinder Sandhu**, Optimization of few-cycle pulse generation: Spatial size, mode quality and focal volume effects in filamentation based pulse compression, **Optics Express** **17**, 23894 (2009).
- 3) P Ranitovic, X M Tong, B Gramkow, S De, B DePaola, K P Singh, W Cao, M Magrakvelidze, D Ray, I Bocharova, H Mashiko, **A Sandhu**, E Gagnon, M M Murnane, HC Kapteyn, I Litvinyuk, C L Cocke, IR-assisted ionization of helium by attosecond extreme ultraviolet radiation, **New J. Phys.** **12**, 013008 (2010).
- 4) **Arvinder S. Sandhu**, Etienne Gagnon, Robin Santra, Vandana Sharma, Wen Li, Phay Ho, Predrag Ranitovic, C. Lewis Cocke, Margaret M. Murnane, Henry C. Kapteyn, Observing the creation of electronic Feshbach resonances in soft x-ray induced O₂ dissociation, **Science** **322**, 1081 (2008).
- 5) Etienne Gagnon, **Arvinder S. Sandhu**, Ariel Paul, Achim Czasch, Till Jahnke, Predrag Ranitovic, Lew Cocke, Margaret M. Murnane, Henry C. Kapteyn, Time resolved momentum imaging system for molecular dynamics studies using table-top extreme ultra-violet light source, **Rev. Sci. Inst.** **79**, 063102 (2008).
- 6) I. Thomann, E. Gregonis, Xuan Liu, Rick Trebino, **A. S. Sandhu**, M. M. Murnane and H. C. Kapteyn, Temporal characterization of attosecond waveforms in the sub-optical-cycle regime with FROGCRAB, **Phys. Rev. A** **78**, 011806 (R) (2008).

ARVINDER S. SANDHU

- 7) Etienne Gagnon, Predrag Ranitovic, Xiao-Min Tong, Lew Cocke, Margaret M. Murnane, Henry C. Kapteyn and **Arvinder S. Sandhu**, Soft X-ray driven femtosecond molecular dynamics, *Science* **317**, 1374 (2007).
- 8) Etienne Gagnon, Isabell Thomann, Ariel Paul, Amy L. Lytle, Margaret M. Murnane, Henry C. Kapteyn and **A. S. Sandhu**, Long term carrier-envelope phase stability from a cryo-cooled, grating-based, chirped pulse amplifier, *Optics Letters* **31**, 1866 (2006).
- 9) **A. S. Sandhu**, Etienne Gagnon, Isabell Thomann, Ariel Paul, Amy Lytle, Tracey Keep, Margaret M. Murnane, Henry C. Kapteyn and Ivan Christov, Generation of Isolated, Carrier-Envelope-Phase insensitive, EUV pulses via Non-linear Stabilization in a Waveguide, *Phys. Rev. A* **74**, 061803(R) (2006).
- 10) M. Anand, **A. S. Sandhu**, S. Kahaly, G. Ravindra Kumar, M. Krishnamurthy, P. Gibbon, Enhanced hard X-ray emission from microdroplet preplasma, *Appl. Phys. Lett.* **88**, 181111 (2006).
- 11) **A. S. Sandhu**, G. Ravindra Kumar, S. Sengupta, A. Das, and P. K. Kaw, Real time study of fast electron transport inside dense hot plasmas, *Phys. Rev. E* **73**, 036409 (2006)
- 12) **A. S. Sandhu**, S. Kahaly, G. R. Kumar, S. Sengupta, A. Das, and P. K. Kaw, Diagnosing the dynamics of fast electron transport with self induced magnetic fields, *J. Phys IV* **133**, 537 (2006)
- 13) **A. S. Sandhu**, G. R. Kumar, S. Sengupta, A. Das, and P. K. Kaw, Laser Pulse Induced Second Harmonic and Hard X-ray Emission: Role of Plasma Wave Breaking, *Phys. Rev. Lett.* **95**, 025005 (2005).
- 14) **A. S. Sandhu**, A.K. Dharmadhikari and G. Ravindra Kumar, Time resolved evolution of structural, electrical and thermal properties of copper irradiated by intense ultrashort laser pulse, *J. Appl. Phys.* **97**, 023526 (2005).
- 15) S. Sengupta, **A. S. Sandhu**, G. R. Kumar, A. Das and P. K. Kaw, Short Laser pulse Induced Generation of Hot electrons and their anomalous stopping in overdense plasmas, *Nuclear Fusion* **45**, 1377 (2005).
- 16) I. Thomann, E. Gagnon, R. J. Jones, **A. S. Sandhu**, A. Lytle, R. Anderson, J. Ye, M. Murnane and H. Kapteyn, Investigation of a grating based stretcher/compressor for carrier-envelope phase stabilized pulses, *Optics Express* **12**, 3493(2004).
- 17) **A. S. Sandhu**, S. Narayanan and G. Ravindra Kumar, Controlling coherent and incoherent plasma emissions: the role of electron plasma waves, *Applied Physics B* **78**, 923(2004).
- 18) A. Dharmadhikari, F. A. Rajgara, N. C. S. Reddy, **A. S. Sandhu** and D. Mathur, Highly efficient white light generation from Barium Fluoride, *Optics Express* **12**, 695 (2004).

ARVINDER S. SANDHU

- 19) A. Dharmadhikari, **A. S. Sandhu**, A. Misra and G. Ravindra Kumar, Measurement of two photon absorption cross-section in organic molecular salt with linear and circular polarized radiation, *Applied Physics B* **79**, 235 (2004).
- 20) P.P. Rajeev, P. Taneja, P. Ayyub, **A. S. Sandhu**, G.R. Kumar, Metal nanoplasmas as bright sources of hard x-ray pulses, *Phys. Rev. Lett.* **90**, 115002 (2003).
- 21) **A. S. Sandhu**, A. K. Dharmadhikari, P. P. Rajeev, G. R. Kumar, S. Sengupta, A. Das, P. K. Kaw, Laser generated Ultrashort Multi-Megagauss Magnetic Pulses in Plasmas, *Phys. Rev. Lett.* **89**, 225002(2002).
- 22) P. P. Rajeev, S. Banerjee, **A. S. Sandhu**, R. C. Issac, L. C. Tribedi and G. R. Kumar, Role of surface roughness in hard x-ray emission from femtosecond laser produced copper plasmas, *Phys. Rev. A* **65**, 052903 (2002).
- 23) P. P. Kiran, N.K.M. Naga Srinivas, D. R. Reddy, B. G. Maiya, and D. N. Rao, A. Dharmadhikari, **A.S. Sandhu**, and G. R. Kumar, Heavy atom effect on non-linear absorption and optical limiting characteristics of 5,10,15,20-(tetra-*o*-tolyl) porphyrinato phosphorus (V) dichloride, *Opt. Comm.* **202**, 347 (2002).
- 24) **A. S. Sandhu** and Sudeep Banerjee, Debabrata Goswami, Suppression of Supercontinuum Generation with Circularly Polarized Light, *Opt. Comm.*, 181, 101(2000).

Refereed Conference proceedings (published in book/journal)

- 25) E. Gagnon, V. Sharma, W. Li, R. Santra, P. Ho, P. Ranitovic, C L Cocke, M M Murnane, H C Kapteyn, A S Sandhu, Autoionization dynamics and Feshbach resonances: Femtosecond EUV study of O₂ excitation and dissociation, *Journal of Physics: Conference Series* **194**, 012014(2009). Proceedings of XXVI ICPEAC, Kalamazoo, MI, USA, 22-29 July, 2009.
- 26) I. Thomann, R. Lock, C. La-O-Vorakiat, E. Gagnon, **A. Sandhu**, H. C. Kapteyn, M. M. Murnane, W.Li, “Direct measurement of the angular-dependence of molecular ionization cross-sections by time-resolved extreme-ultraviolet spectroscopy,” in *Ultrafast Phenomena XVI, Springer Series in Chemical Physics, Vol. 92* (2009).
- 27) **A. S. Sandhu**, Etienne Gagnon, Predrag Ranitovic, Xiao-Min Tong, Lew Cocke, Margaret M. Murnane, Henry C. Kapteyn and, Direct time resolved observation of molecular dynamics induced by soft-x-ray photoionization, *Journal of Physics Conference Series*, **88**, 012037 (2007) as proceedings of *International conference on photonic, electronic and atomic collisions, Freiburg, Germany* (2007).
- 28) **A. Sandhu**, E. Gagnon, A. Paul, I. Thomann, A. Lytle, T. Keep, M. Murnane, H. Kapteyn, I. Christov, Isolated EUV Pulses via CEP-insensitive Nonlinear Stabilization in a Waveguide, *Ultrafast Phenomenon XV, Springer Series in Chemical Physics, Vol. 88*, 2007, pp 39).

ARVINDER S. SANDHU

- 29) X. Zhang, D. Raymondson, **A. S. Sandhu**, S. Backus, M. Murnane and H. Kapteyn, High resolution imaging system using tabletop extreme ultraviolet source, *Proc. SPIE (Bellingham WA)*. **5534**, 47 (2004).
- 30) **A. S. Sandhu**, A. K. Dharmadhikari, P.P. Rajeev, G. Ravindra Kumar, S. Sengupta, A. Das and P.K. Kaw, Ultrashort Magnetic pulses from Laser Solid Interaction, *OSA trends in Optics and Photonics Series* **88**, pp 1057 (2003).
- 31) **A. S. Sandhu**, A. K. Dharmadhikari, P.P. Rajeev, G. Ravindra Kumar, S. Sengupta, A. Das and P.K. Kaw, Evidence of fast electron Inhibition via magnetic pulse measurements, *IFSA 2003 Conference Proceedings*, Eds. B. A. Hammel, D. D. Meyerhofer, J. Meyer-ter-vehn, H. Azechi, American Nuclear Society, Monterey CA, USA (2003).
- 32) P.P. Rajeev, **A.S. Sandhu**, P. Taneja, P. Ayyub, and G. Ravindra Kumar, “Enhanced Fields and Enhanced Coupling on Nano-structured Surfaces”, *IFSA 2003 Conference Proceedings*, Eds. B. A. Hammel, D. D. Meyerhofer, J. Meyer-ter-vehn, H. Azechi, American Nuclear Society, Monterey CA, USA, (2003).
- 33) **A. S. Sandhu**, A. Dharmadhikari, P. P. Rajeev and G. R. Kumar, Temporal evolution of self generated magnetic fields in laser-solid interaction, *Proc. of Conf. on Inertial Fusion Science and Applications 2001*, Eds: K.A. Tanaka, D.D. Meyerhofer, J.Meyer-ter-Vehn Elsevier Science, pp.349 (2002).

Articles in Books

- 34) D. Goswami, **A. S. Sandhu**, An Experimental Perspective on Coherent Control, *Advances in Multiphoton Processes and Spectroscopy, Vol. 13*, ed. S.H. Lin, A.A. Villaeys, and Y. Fujimura (World Scientific) 2000.

Patents

M. Anand, M. Krishnamurthy, A. S. Sandhu, G. Ravindra Kumar (TIFR), K. Tanaka, R. Kodama, Y. Kitagawa and K. Kondo (Osaka Univ.), Efficient Hard X-ray source - occurrence method and device, JP2005346962 Japan (2005).

ARVINDER S. SANDHU

Invited Workshops Presentations

- “Probing electron dynamics in atoms and molecules with high-harmonic XUV pulses”, 463. WE-Heraeus-Seminar on Ultrafast Atomic Physics, Physikzentrum Bad Honnef, Germany (Aug 20, 2010).
- “Attosecond and femtosecond wavepacket dynamics in atoms and molecules”, Workshop on The Future of Ultrafast Soft-x-ray Science, Lawrence Berkeley National Labs (LBNL), Berkeley, CA, USA (Nov 30 – Dec 3, 2009).

Invited Seminars

- “Real-time visualization of electron dynamics: New possibilities in measurement and control on attosecond timescales”, Indian Institute of Science Education and Research (IISER) Mohali, Chandigarh, India (Aug 12, 2010).
- “Femtosecond movie of a highly excited molecule”, Low energy seminar, Physics Department, Tucson AZ (Sep 20, 2007).
- “Non-linear EUV photonics: Applications in Attosecond Science”, ACMS seminar, College of Optical Sciences, Tucson AZ, USA (Oct 18, 2007).
- “Ultrafast dynamics of dense plasmas”, Invited Research Presentation, Indian National Science Academy, Delhi, India (May 28, 2007).
- “Application of Non-linear EUV photonics”, Department of Physics, University of Arizona, Tucson USA (Sep 30, 2006).
- “Reaction Microscopy with XUV sources”, Research Seminar, University of Nebraska, Lincoln USA (Mar 7, 2006).
- “Applications of high harmonics in Attosecond Science”, TIFR Alumni Award Presentation, Tata Institute of Fundamental Research, Mumbai, India (April 21, 2005).
- “Reaction Microscopy experiments with high-harmonic sources”, *Joint Inst. of Lab. Astrophysics (JILA)*, Boulder, USA (Oct 22, 2004).
- “Magnetic fields, X-rays and Harmonics with two-pulse experiments”, Plasma Physics Dept., *Imperial College of Science Technology and Medicine*, London, UK (Oct 9, 2003).
- “Role of Plasma waves in coherent and incoherent emissions in laser-solid experiments”, Atomic Molecular and Optical Physics, *University of Texas*, Austin, USA (Oct 2, 2003).

ARVINDER S. SANDHU

- “Time-Resolved Ultrashort laser plasma interaction studies”, *Joint Inst. of Lab. Astrophysics (JILA)*, Boulder, USA (Sep 5, 2003).
- “Magnetic Information Storage: Role of Ultrashort Lasers”, Photonics 2002, *Tata Institute of Fundamental Research*, Mumbai, India (Dec 16, 2002).
- “Zero to Megagauss in Picoseconds”, Dept. of Nuclear and Atomic Physics, *Tata Institute of Fundamental Research, Mumbai*, India (May 17, 2002).
- “Intense ultrashort laser generated magnetic fields”, Dept. of Physics, *G. N. D. University*, Amritsar, India (Jan10, 2001).

Invited Colloquia

- “Exploring femtosecond and attosecond phenomena with ultrashort light pulses”, Physics Colloquium, University of Arizona, Tucson USA (Jan 25, 2008).
- “Exploring the attosecond and nanometer world”, Physics Colloquium, University of Nebraska, Lincoln USA (March 6, 2006).
- “Ultrafast Science: A window into Attosecond and Nanometer world”, Physics Colloquium, University of Arizona, Tucson, USA (December 7, 2005)
- “Attosecond Science: Tools and Applications”, Institute of Plasma Research, Ahmedabad, India (April 18, 2005).

Invited Conference talks

1. **Invited Talk** - “Real-time observation of attosecond and femtosecond quantum dynamics using ultrafast lasers” Arvinder S Sandhu, APS- 4 Corners meeting Golden CO, USA (Oct 23-24, 2009).
2. **Invited Special Report** - “Auto-ionization dynamics and Feshbach resonances: Femtosecond XUV study of O₂ excitation and dissociation” Arvinder S Sandhu, Etienne Gagnon, Predrag Ranitovic, Xiao-Min Tong, C L Cocke, Robin Santra, Margaret M Murnane and Henry C Kapteyn, ICPEAC XXVI, Kalamazoo, MI. (July 22-29, 2009).
3. **Invited Talk** - “Probing femtosecond dynamics of highly-excited molecular states”, Arvinder S Sandhu, Etienne Gagnon, Predrag Ranitovic, Xiao-Min Tong, C L Cocke, Robin Santra, Margaret M Murnane and Henry C Kapteyn, Gordon Research Conference (Multiphoton Processes), Tilton June 8-13, 2008.

ARVINDER S. SANDHU

4. **Invited talk**- Real time dynamics of high-excited molecules using femtosecond EUV sources, Arvinder S Sandhu, Etienne Gagnon, Predrag Ranitovic, Xiao-Min Tong, C L Cocke, Robin Santra, Margaret M Murnane and Henry C Kapteyn, Internation workshop on photo-ionization (IWP 2008), June 15-19, Satra Brunn, Sweden.
5. **Invited talk** - “Using high-harmonics for probing real-time dynamics of highly excited molecules,” Arvinder S Sandhu, Etienne Gagnon, Predrag Ranitovic, Xiao-Min Tong, C L Cocke, Robin Santra, Margaret M Murnane and Henry C Kapteyn, DAMOP, May 27-31, 2008, State College, PA.
6. **Invited talk** - “Soft x-ray driven femtosecond fragmentation dynamics of molecular shakeup states”, Arvinder S Sandhu, Etienne Gagnon, Predrag Ranitovic, Xiao-Min Tong, C L Cocke, Margaret M Murnane and Henry C Kapteyn, Ultrafast Optics- High Field Short wavelength Sources Conference UFO-HFSW, Santa Fe, Sep2- Sep7 (2007). Presented by E. Gagnon
7. **Invited talk** - “Molecular science using strong-field and high-order harmonic generation,” A. Sandhu, E. Gagnon, N. Wagner, X. Zhou, R. Hooper, M.M. Murnane, and H.C. Kapteyn, 16th International Laser Physics Workshop (LPHYS'07), Leon, Mexico, August 2007. Presented by Henry Kapteyn.
8. **Invited Special Report** - “Direct time resolved observation of molecular dynamics induced by extreme ultraviolet photoionization”, Arvinder S Sandhu, Etienne Gagnon, Predrag Ranitovic, Xiao-Min Tong, C L Cocke, Margaret M Murnane and Henry C Kapteyn, XXV International Conference on Photonic, Electronic and Atomic Collisions, Freiburg, Germany July 25-31 (2007).

Contributed Conference Presentations

1. **Talk** - Niranjana Shivaram, Adam Roberts, Lei Xu, Arvinder Sandhu “Using Ion imaging to study the effect of Guoy phase shift and wavefront distortions on Attosecond pump-probe experiments”, 17th International Conference on Ultrafast Phenomena, Snowmass CO, USA (18-23 July, 2010).
2. **Poster** - Niranjana Shivaram, Adam Roberts, Lei Xu, Arvinder Sandhu “*In-Situ* Spatial Mapping of Gouy Phase Shift for Attosecond Pump-Probe Experiments”, *Gordon Research Conference*, Tilton NH, USA (6-11 June, 2010). Presented by N. Shivaram.
3. **Talk** - Niranjana Shivaram, Lei Xu, Adam Roberts, Arvinder Sandhu “Using Ion-imaging to Measure Gouy Phase Shift and Wavefront Distortions for Attosecond Pump-Probe Experiments”, Session L6, 41st Annual Meeting of the APS Division of Atomic, Molecular, and Optical Physics (*DAMOP*), *Houston, Texas, May 25-29, 2010*. Presented by N. Shivaram.

ARVINDER S. SANDHU

4. **Poster** - P. Ranitovic, X.-M. Tong, B. Gramkow, S. De, B. DePaola, K. P. Singh, W. Cao, M. Magrakvelidze, D. Ray, I. Bocharova, H. Mashiko, E. Gagnon, A. Sandhu, M. M. Murnane, H. C. Kapteyn, I. Litvinyuk, C.L. Cocke, "IR-Assisted Ionization of He by Attosecond XUV Radiation", *J. Phys.: Conf. Ser.* **194**, 032036 (2009). Presented by C. L. Cocke at *ICPEAC, Kalamazoo, MI, USA*, 22-29 July, 2009.
5. **Talk** - "The Creation of Super-Excited Electronic Feshbach Resonances by EUV-Induced Dissociation of O₂" Etienne Gagnon, Arvinder S. Sandhu, Vandana Sharma, Robin Santra, Wen Li, Phay Ho, Predrag Ranitovic, C L. Cocke, Margaret M. Murnane, Henry C. Kapteyn *CLEO/IQEC OSA Tech. Digest JThD*, 2 (2009). Presented by Etienne Gagnon at *CLEO 2009*.
6. **Talk** - "Direct measurement of the angular-dependence of molecular ionization cross-sections by time-resolved extreme-ultraviolet spectroscopy," I. Thomann, R. Lock, C. La-O-Vorakiat, E. Gagnon, A. Sandhu, H. C. Kapteyn, M. M. Murnane, W. Li, 16th International Conference on Ultrafast Phenomena, Stresa Italy, June 2008. Presented by Isabell Thomann.
7. **Talk** - "EUV-Driven Attosecond Processes," Predrag Ranitovic, B. Gramkow, D. Ray, M. Magrakvelidze, I. Bocharova, S. De, H. Mashiko, I. Litvinyuk, C.L. Cocke, H. Kapteyn, M. Murnane, A. Lytle, E. Gagnon, A. Paul, A. Sandhu, G.G. Paulus, X.M. Tong, and A. Alnaser, APS Division of Atomic, Molecular, and Optical Physics Meeting (DAMOP), State College, Pennsylvania, May 2008. Paper J6.00011. Presented by Predrag Ranitovic.
8. **Talk** - "Angular-Dependence of Molecular Photoionization Cross-Sections Studied by Time-Resolved EUV Spectroscopy," Isabell Thomann, Robynne Lock, Etienne Gagnon, Arvinder Sandhu, Henry C. Kapteyn, Margaret M. Murnane, and Wen Li, OSA Conference on Lasers and Electro-optics/ Quantum Electronics and Laser Science (CLEO/QELS), San Jose, CA, May 2008. Paper JFF1. Presented by Isabell Thomann.
9. **Talk** - "Direct time-resolved observation of molecular dynamics induced by extreme-ultraviolet photoionization", Arvinder S Sandhu, Etienne Gagnon, Ariel Paul, Predrag Ranitovic, C L Cocke, Margaret M Murnane and Henry C Kapteyn, 38th annual meeting of the Divison of Atomic, Molecular, and Optical Physics, Alberta, Canada June 5-9, (2007).
10. **Poster** - "Soft x-ray driven femtosecond dynamics of N₂ ionic Rydberg states", Etienne Gagnon, Predrag Ranitovic, Xiao-Min Tong, C L Cocke, Margaret M Murnane and Henry C Kapteyn, Arvinder S Sandhu,, 38th annual meeting of the Divison of Atomic, Molecular, and Optical Physics, Alberta, Canada, June 5-9 (2007).
11. **Postdeadline talk**, "Soft x-ray driven femtosecond molecular dynamics," Arvinder S. Sandhu, Etienne Gagnon, Ariel Paul, Predrag Ranitovic, C. Lewis Cocke, Margaret M. Murnane and Henry C. Kapteyn, OSA Conference on Lasers and Electro-optics/ Quantum Electronics and Laser Science (CLEO/QELS), Baltimore, MD, May 2007. Paper QPDA5.
12. **Poster** - "Using high-order harmonics with momentum imaging techniques to study atomic and molecular dynamics" Etienne Gagnon, Margaret M. Murnane, Henry C. Kapteyn and

ARVINDER S. SANDHU

Arvinder Sandhu, OSA Conference on Lasers and Electro-optics/ Quantum Electronics and Laser Science (CLEO/QELS), Baltimore, MD, May 2007.

13. **Talk** - "Using high-order harmonics with momentum imaging techniques to study atomic and molecular dynamics" Arvinder Sandhu, Etienne Gagnon, Margaret M. Murnane, Henry C. Kapteyn and Arvinder Sandhu, American Physical Society March Meeting, Denver CO, March 2007.
14. **Talk** - "Non-linear EUV photonics- Applications in Attosecond and Nanometer Science" Arvinder S. Sandhu, 4th New Laser Scientist Conference, Rochester, NY October (2006).
15. **Talk** - "Isolated, CEP Insensitive, EUV pulses via Gated Phase Matching Mechanism in a Waveguide", A. S. Sandhu, Etienne Gagnon, Ariel Paul, Isabell Thomann, Amy L. Lytle, Tracey Keep, Margaret M. Murnane, Henry C. Kapteyn, Ivan Christov, Frontier in Optics and Laser Science XXII, Rochester, NY Oct 8-12 (2006).
16. **Poster** - "Isolated EUV pulses via CEP-insensitive non-linear stabilization in the waveguide", A. S. Sandhu, Etienne Gagnon, Ariel Paul, Isabell Thomann, Amy L. Lytle, Tracey Keep, Margaret M. Murnane, Henry C. Kapteyn, Ivan Christov, 15th International Conference on Ultrafast Phenomenon, Pacific Grove CA, USA (2006).
17. **Talk** - "Subfemtosecond EUV pulses via energy selective non-linear stabilization in the waveguide", A. S. Sandhu, Etienne Gagnon, Ariel Paul, Isabell Thomann, Amy L. Lytle, Margaret M. Murnane, Henry C. Kapteyn, Ivan Christov, CLEO 2006, Longbeach CA, USA (2006).
18. "Two topics relevant to QC," Etienne Gagnon, Isabelle Thomann, Nick Wagner, Amy Lytle, Dr. Arvinder Sandhu, Dr. Andrea Wüest, Prof. Margaret M. Murnane, Prof. Henry C. Kapteyn, Ivan Christov, Mark Baertschy, Chris Greene, Jun Ye, Jason Jones, and Tamar Seidemann, 2005 Gordon Conference on Quantum Control Of Light And Matter, Waterville, Maine, August 2005. Invited Talk presented by Henry Kapteyn.
19. "Extreme nonlinear optics for coherent X-ray generation: applied attosecond science," Ron Tobey, Mark Siemens, Luis Avrila, Guido, Emily Gibson, Xiaoshi Zhang, Ariel Paul, Amy Lytle, Arvinder Sandhu, Isabell Thomann, Etienne Gagnon, Ivan Christov, Keith Nelson, Martin Aeschliman, John Gland, David Attwood, Henry Kapteyn, and Margaret Murnane, Femtochemistry VII, Washington DC, July 2005. Invited talk presented by M. Murnane.
20. **Talk** - "Long term carrier-envelope phase coherence in a grating-based chirped pulse amplifier system," Etienne Gagnon, Arvinder Sandhu, Isabell Thomann, Ariel Paul, Amy L. Lytle, Sterling Backus, Margaret Murnane, and Henry Kapteyn, 89th Annual Meeting of the Optical Society of America, Frontiers in Optics/Laser Science XXI (OSA/ILS), Tucson, AZ, October 2005. Presented by E. Gagnon.
21. **Poster** - "Long-term carrier envelope phase stability with grating based amplifier", A. S. Sandhu, Etienne Gagnon, Isabell Thomann, Ariel Paul, Amy L. Lytle, Margaret M.

ARVINDER S. SANDHU

- Murnane, Henry C. Kapteyn. *International Conference on Multiphoton Processes (ICOMP)*, Orford, Canada, Oct 9-14 (2005).
22. **Talk** - "Characterization of carrier-envelope phase noise from a grating based stretcher/compressor for chirped pulse amplification", I. Thomann, E. Gagnon, R. J. Jones, A. S. Sandhu, A. Lytle, R. Anderson, J. Ye, M. Murnane and H. Kapteyn, CTuR3 *CLEO*, Baltimore MD, USA (2005), Presented by I. Thomann.
 23. "Extreme nonlinear optics for coherent X-ray generation: applied attosecond science," Emily Gibson, Xiaoshi Zhang, Ariel Paul, Amy Lytle, Arvinder Sandhu, Isabell Thomann, Etienne Gagnon, Henry Kapteyn, Margaret Murnane, and Ivan Christov, Gordon Research Conference on Atomic Physics, Tilton, New Hampshire, June 2005. Invited talk, Presented by Margaret Murnane.
 24. **Poster** - "Grating based stretcher/compressor for carrier-envelope phase stabilized pulses" I. Thomann, E. Gagnon, R. J. Jones, A. S. Sandhu, A. Lytle, R. Anderson, J. Ye, M. Murnane and H. Kapteyn, *Gordon Research Conference*, Tilton NH, USA (2004). Presented by I. Thomann.
 25. **Talk** - "Generation of Relativistic Electron Beam and its Anomalous stopping in the Fast Ignition scheme" S. Sengupta, A.S.Sandhu, G. R. Kumar, A. Das and P. K. Kaw, *Proc. of 20th IAEA Fusion Energy Conference, Vilamoura, Portugal* (2004). Presented by S. Sengupta.
 26. **Talk** - "Prepulse dependence in hard X-ray generation from microdroplets", M. Anand, A. S. Sandhu, S. Kahaly, G. Ravindrakumar, M. Krishnamurthy and P. Gibbon, *Third International Conference on Superstrong fields in plasmas, Varenna, Italy*, Sep 19-24 (2005). Presented by M. Krishnamrthy,
 27. **Poster** - "Real time monitoring of fast electron transport in hot dense plasmas", A. S. Sandhu, G. R. Kumar, S. Sengupta, A. Das and P. K. Kaw, *Fourth International conference on Inertial Fusion Sciences and Application, Biarritz, France*, Sep 9-14 (2005).
 28. **Poster** - "Controlling the Coherent and incoherent plasma emissions: Role of plasma wave excitation and breaking", A.S. Sandhu, S. Narayanan and G. Ravindra Kumar, *High Field Short Wavelength Sources X*, Biarritz, France (2003).
 29. **Poster** - "Magnetic Information Storage: Role of Ultrashort laser", A. S. Sandhu, A. K. Dharmadhikari, P. P. Rajeev, G. Ravindra Kumar, *Photonics 2002*, TIFR, Mumbai, India (2002).
 30. **Poster** - "Megagauss magnetic fields in intense femtosecond laser solid interaction", A. S. Sandhu, P.P. Rajeev, G. R. Kumar, *National Laser Symposium*, Laser Science and Technology Center, Delhi (2000).

ARVINDER S. SANDHU

31. **Poster** - “Enhancement of x-ray production using Nanoparticle coated solid targets”, P. P. Rajeev, A. S. Sandhu and G. Ravindra Kumar, *National Laser Symposium*, LASTEC, Delhi (2000).
32. **Poster** - “Polarization dependence of x-ray emission from femtosecond laser produced copper plasmas”, P. P. Rajeev, A. S. Sandhu, S. Banerjee, R. C. Issac, L. C. Tribedi and G. Ravindrakumar, *National Laser Symposium*, LASTEC, Delhi (2000).
33. **Talk** - “Femtosecond Continuum: Polarization Induced Control” A. S. Sandhu, S. Banerjee, D. Goswami, *Optical Society of America, Annual Meeting/ILS-XVI*, Rhode Island, USA, Oct 22-26 (2000).
34. **Poster** - “On the Coherent Control of Biomolecules in Condensed Phase”, A.S. Sandhu and Debabrata Goswami, *National Symposium on Magnetic Resonance and Biomolecular Structure and Function 2000* (Invited Talk), L40, TIFR, Mumbai, India, January 17-20 (2000).
35. **Poster** - “Current Perspective on Ultrafast Optical Pulse Shaping”, A. S. Sandhu and Debabrata Goswami, *Trombay Symposium on Radiation and Photochemistry (TSRP-2000)*, P68, BARC, Mumbai, India, January 12-17 (2000).
36. **Poster** - “Polarization Induced Effects in Femtosecond Supercontinuum Generation”, A. S. Sandhu, Sudeep Banerjee and Debabrata Goswami, *National Laser Symposium 1999*, Univ. of Hyderabad, Hyderabad, India, Dec. 15-17 (1999).
37. **Poster** - “Towards Medical Applications of Femtosecond Lasers: Throughput enhancement in Optical Fibers with Pulse Shaping”, A. S. Sandhu, and Debabrata Goswami, *National Laser Symposium 1999*, Univ. of Hyderabad, Hyderabad, India, Dec. 15-17 (1999).
38. **Poster** - “Optical Pulse Shaping for throughput enhancement in Optical Fibers: Towards developing a better Delivery System for Medical Applications”, A. S. Sandhu and Debabrata Goswami, *Symposium on Recent Trends in Bio-Medical Research 1999*, P52, TIFR, Mumbai, India, September 27-29 (1999).
39. **Post-Deadline Poster** - “Polarization Induced Efficiency Variations in Femtosecond Supercontinuum Generation”, S. Banerjee, A.S. Sandhu, D. Goswami, *OSA Annual Meeting* (Post-deadline Paper), Santa Clara, CA, USA, September 26-30 (1999).