

# Aziz Kolkiran

POSTDOCTORAL RESEARCH ASSOCIATE

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## Objective:

A Faculty/Research Associate position in academy in the field of quantum optics and condensed matter theory focused on both the fundamental and the applicable aspects as well as theoretical and computational projects in quantum information science.

## Qualifications:

- Proven academic excellence in three major fields (photonics, physics, and mathematics).
- Solid record of awards and academic performance, including internationally recognized research fellowship, outstanding theoretical research assistant award and Dean's scholarship.
- Experience in broad range of projects and research including both experiment and theory.

## Current Research Interests:

- Quantum Coherence and Quantum Information Theory in Mesoscopic Systems.
- Theoretical studies of entangled light and atoms in the context of quantum imaging and sensing as well as quantum information and computation processing.
- Theoretical investigations of quantum effects in nano-mechanical systems.
- Heisenberg-limited measurements.
- Quantum metrology.

## Education:

- **Doctor of Philosophy in Photonics, GPA 3.96**, Oklahoma State University, Stillwater, Oklahoma, 2003 – July 2008).  
Thesis title: "Quantum imaging and sensing with entangled photons."  
**Quantum Optics and Quantum Information Science Group**,  
Advisor: Prof. Girish S. Agarwal.
- Research on **Quantum Computation and Information**, Universität Stuttgart, 4. Physikalisches Inst., Stuttgart, Germany, July 2002 – January 2003.
- Research on **Theoretical Quantum Computation**, Department of Physics, Middle East Technical University, Ankara, Turkey, February 1999 – June 2002.

- **Master of Science in Physics, GPA 3.68,** Middle East Technical University, Ankara, Turkey, August 1996 – February 1999.  
Thesis title: “Classical Dynamics of p-Branes.”  
Advisor: Prof. Tekin Dereli.
- **Bachelor of Science in Physics, GPA 3.64, Ranked first among 80 graduates,** Middle East Technical University, Ankara, Turkey, September 1992 – July 1996.
- **Bachelor of Science in Mathematics, GPA 3.66, Double Major Program with Physics,** Middle East Technical University, Ankara, Turkey, September 1993 – July 1996.

### **Employment and Research / Project History:**

- Postdoctoral Research Associate, Department of Physics, Mesoscopic Physics & Quantum Information Group, Chonnam National University, Gwangju, South Korea, October 2008 – present.  
Research on electron charge detection sensitivity in electronic interferometers.  
Teaching graduate level Quantum Optics course.
- Research Assistant, Department of Physics, Quantum Optics and Quantum Information Science Group, Oklahoma State University, Stillwater, Oklahoma, June 2005 – July 2008.  
Researched on **Heisenberg-limited precision measurements in magnetometry and Sagnac interferometry using nonclassical light, quantum imaging and lithography using stimulated parametric down-conversion** and **quantum optics of nano-mechanical systems**.  
Group leader: Prof. Girish S. Agarwal.
- Research Assistant, Center for Laser and Photonics Research, Oklahoma State University, Stillwater, Oklahoma, Summer of 2004.  
Researched on **Dipole radiation patterns of nanoparticle coated whispering-gallery mode fused-silica micro-spheres**.  
Project leader: Prof. A. T. Rosenberger.
- Teaching Assistant, Department of Physics, Oklahoma State University, Stillwater, Oklahoma, August 2003 – May 2005.  
Instructed laboratory and recitation sections for general physics.
- Accomplished graduate projects in **Advanced Photonics Laboratory**, Department of Electrical and Computer Engineering, Oklahoma State University, Stillwater, Oklahoma, Fall 2004 :
  - **Diode laser project:** Construction and operation of a diode laser; principles and operation of monochromators, gratings, lock-in nanovoltmeter, photodiode light detectors.
  - **Dye Laser / Detectors Project:** Construction and operation of a dye laser; principles of avalanche photodiodes, photoresistors and phototransistors.
  - **Two-photon Absorption Project:** Propagation and focusing of gaussian beams; two-photon absorption; principle of operation, properties and limitations of photomultiplier; detection of signals below the noise level.

- **Photoluminescence of Chromium Doped Crystals:** Energy levels of Cr 3+ ions in ruby, alexandrite and emerald; operation of a photomultiplier as a photon counter.

Project advisor: Prof. Jerzy Krasinski.

- Accomplished graduate projects in **Optoelectronics Laboratory**, Department of Electrical and Computer Engineering, Oklahoma State University, Stillwater, Oklahoma, Spring 2004 :
  - **Optical Tweezer:** Design, construction and operation of an optical tweezer for trapping and manipulating enzyme carrying microspheres.
  - **Diode Pumped Solid State Laser:** Design, construction and operation of a diode pumped solid state laser.

Project advisor: Prof. A. Cheville.

- Research Assistant, 4. Physikalisches Inst., Universitt Stuttgart, Stuttgart, Germany, July 2002 - January 2003.  
Researched on **Quantum dot nuclear spin polarization**.
- **32nd International Physics Olympiad**, served as a **Jury Member in the Evaluation Committee**, employed by The Scientific and Technological Research Council of Turkey, Antalya, Turkey, June 28 - July 6, 2001.
- Teaching Assistant, Department of Physics, Middle East Technical University, Ankara, Turkey, August 1996 – June 2002.
- Undergraduate Teaching Assistant, Department of Physics, Middle East Technical University, Ankara, Turkey, September 1993 - June 1996.

## Honors & Awards:

- **Outstanding Theoretical Research Assistant Award** by the Department of Physics, Oklahoma State University, April 2008.
- Merit based **travel grant** from American Physical Society Division of Laser Science for The 90th Optical Society of America Annual Meeting, October 2006.
- **Alexander von Humboldt Foundation Research Fellowship** with a monthly stipend of 2000 Euros for a period of 24 months, Stuttgart, Germany, July 2002.
- **First Rank Student Medal** by the President of University, High Honor Student in the **Dean's List** for 3 years, Department of Physics, Middle East Technical University, Ankara, Turkey, July 1996.
- **Dean's Scholarship** for 3 years, Middle East Technical University, Ankara, Turkey, 1994 – 1996.
- Selected into the **Advanced Physics Program** for highly motivated and successful students by the Department of Physics, Middle East Technical University, Ankara, Turkey, September 1993.

## Publications:

1. “Quantum limits to interferometry using entangled light,” Aziz Kolkiran and G. S. Agarwal, in preparation.
2. “Quantum interferometry using coherent beam stimulated parametric down-conversion,” Aziz Kolkiran and G. S. Agarwal, *Opt. Express* **16**, 6479-6485 (2008).
3. “Heisenberg limited Sagnac interferometry,” Aziz Kolkiran and G. S. Agarwal, *Opt. Express* **15**, 6798-6808 (2007).
4. “Towards the Heisenberg limit in magnetometry with parametric down-converted photons,” Aziz Kolkiran and G. S. Agarwal, *Phys. Rev. A* **74**, 053810 (2006).
5. “Quantum properties of a nano-mechanical oscillator,” Aziz Kolkiran and G. S. Agarwal, [eprint **cond-mat/0608621**]
6. “Machines and quantum logic,” Aziz Kolkiran, A popular science article in Turkish, *Journal of Science and Technology* **400**, 81 (2001).

## International Conferences and Workshops / Seminars and Colloquia:

1. “Heisenberg Limited Sagnac Interferometry with Higher Order Entanglement,” **contributed joint poster**, *OSA Topical Meeting, International Conference on Quantum Information (ICQI) and Ninth Conference on Coherence in Quantum Optics (CQO9)*, Rochester, New York, 10 –15 June, 2007.
2. “Heisenberg limited Sagnac interferometry,” **contributed talk** in the focus session on quantum limited measurements, *American Physical Society March meeting*, Denver, Colorado, 5 – 9 March, 2007.
3. “Towards Heisenberg limit in magnetometry with parametric down-converted photons,” **contributed talk** in the session on precision and quantum enabled measurements, *Frontiers in Optics 2006/Laser Science XXII, The 90th Optical Society of America Annual Meeting*, Rochester, New York, 8 – 12 October, 2006.
4. “Towards Heisenberg limit in magnetometry with parametric down-converted photons,” **contributed poster**, *International Focus Workshop on Linear Optical Quantum Information Processing (LOQuIP)*, Baton Rouge, Louisiana, 9 - 12 April, 2006.
5. “Heisenberg limited magnetometry,” **Departmental Seminar**, *Journal Club on Statistical Mechanics, Condensed Matter Physics and Optics*, Department of physics, Oklahoma State University, Stillwater, Oklahoma, March 24th, 2006.
6. “Squeezing in a nano-mechanical oscillator,” **contributed poster**, *12th Central European Workshop on Quantum Optics (CEWQO) 2005*, Ankara, Turkey, 6 - 9 June , 2005.
7. *QIP 2001: Fourth Workshop on Quantum Information Processing*, Amsterdam, Netherlands, 9 – 12 January, 2001.

## Professional Society Memberships:

- American Physical Society (APS), Optical Society of America (OSA)