William N. Plick

Education

1. Ph.D, Physics, Louisiana State University, 2010.
2. B.S. Physics, Minors: Astronomy, Comparative Religion, Connecticut College, 2004.
3. High School, Saint Augustine College Preparatory School, 2000.

Research Positions

1. Assistant Professor of Physics at the University of Dayton (2016-Present).
2. Post-Doctoral Researcher at CNRS LTCI and Télécom ParisTech (2014-2016).
3. Post-Doctoral Researcher at the University of Vienna and The Institute for Quantum Optics and Quantum Information (2010-2014).
4. Graduate Research Assistantship at Louisiana State University (2005-2010).
5. Undergraduate Research Assistantship at Connecticut College (2003).
6. Undergraduate Research Assistantship (REU) at the National Solar Observatory (2002).

Teaching Experience and Outreach

1. Assistant Professor of Physics (teaching various levels of intro physics, and independent studies in quantum optics) – University of Dayton (2016 - Present).
2. Have mentored several undergraduate students who assisted with research – University of Dayton (Spring 2016 - Present)
3. Served as Übungsleiter (Recitation Leader) for First-Year Physics – University of Vienna (Winter Term, 2012 - 2013).
4. Participated in Prof. Zeilinger's "Quanta Now" Exhibition at the dOCUMENTA(13) Modern Art Show – Kassel, Germany (Spring 2012).
5. Mentored summer high-school student who assisted in research – University of Vienna (Summer 2011).
6. Organized "Saturday Science" (year-long, weekly science outreach for high school students) at Louisiana State University (2006).
7. English as a Second Language Teacher – NOVA Corporation, Yamagata, Japan (2004 - 2005).

Research Interests

1. **Quantum Optical Metrology:** I have done a significant amount of theoretical work on the use of non-classical light to improve the capacity of sensing devices. Specifically the use of squeezed-vacuum and squeezed-coherent states in interferometers, as well as detection with parity. I also received funding from Sandia National Labs to investigate potential improvements in optical magnetometry using quantum resources. My interest is not only in the design and improvement of the devices themselves but also the theory of the information content of systems and the nature of measurement. I am active in research today in the new and growing field of non-linear interferometry.

2. **Quantum Computing and Communication:** I have a strong interest in optical quantum information transfer and its applications (quantum secret sharing, etc.). This includes an emphasis on how such tasks my be achieved in realistic conditions through free-space or telecom fibers. I also have a working knowledge of quantum information processing and the general state of research into quantum computation. Specifically, I have aided in research on optical implementations of continuous-variable, cluster-state (measurement-based) quantum computing; and have a working knowledge of related topics.

3. **Foundations of Quantum Mechanics:** This one of my main interests in physics. I am especially interested in how non-classical light may be used to test the fundamental laws of quantum mechanics. I do research on the topics of violation of local-realism in novel systems, and contradictions between the classical world-view and quantum physics going beyond the assumption of local-realism, and in quantum contextuality. Recently, I have become interested in how so-called "quantum-like models" may be applied to non-traditional areas of research such as sociology.

4. **The Orbital Angular Momentum and Complex Spatial Modes of Light:** I do extensive research into the generation, entanglement, and detection of both standard and novel orbital-angular-momentum-carrying light. Especially my interest is in the properties of spatially-complex beams which serve as excellent test-beds for understanding the connections between optical vortices, phase singularities, topological charge, and the orbital angular momentum. I am also interested in electromagnetic fields that display "unusual" symmetries. These photonic modes also have a vast array of interesting properties which are only just beginning to be understood. Most recently I have been investigating the properties of such modes under relativistic transformations.

Peer-Reviewed Publications:

1. *Violating Bell inequalities with entangled optical frequency combs and multipixel homodyne detection*
   W.N. Plick, F. Arzani, N. Treps, E. Diamanti, and D. Markham
   Physical Review A 98, 062101 (2018).
   Chosen for PRA's "Kaleidoscope".
2. *Physical meaning of the radial index of Laguerre-Gauss beams*
   W.N. Plick, and M. Krenn.
   Physical Review A **92**, 063841 (2015).
3. *An extension of the Wigner inequality: theory and experiment*
   W.N. Plick, R. Fickler, R. Lapkiewicz, and S. Ramelow.
   Physical Review A **91**, 022124 (2015).
   Chosen for PRA's "Kaleidoscope".

4. *An explicit contextualized realistic hidden variable model replicating an indivisible quantum system*
   W.N. Plick, and R. Lapkiewicz.
   Physical Review A **89**, 022108 (2014).

5. *Quantum orbital angular momentum of elliptically-symmetric light*
   W.N. Plick, M. Krenn, R. Fickler, S. Ramelow, and A. Zeilinger.
   Physical Review A **87**, 033806 (2013).

6. *Entangled singularity patterns of photons in Ince-Gauss modes*
   M. Krenn, R. Fickler, M. Huber, R. Lapkiewicz, W.N. Plick, S. Ramelow, A. Zeilinger.
   Physical Review A **87**, 012326 (2013).

7. *Quantum Entanglement of Very High Angular Momenta*
   R. Fickler, R. Lapkiewicz, W.N. Plick, M. Krenn, C. Schaeff, S. Ramelow, A. Zeilinger.
   Science **338**, 640 (2012).
   Chosen for Physics World's "Top 10 breakthroughs for 2012", and winner of the "2013 Best Scientific Paper from the City of Vienna" award.

8. *Parity detection in quantum optical metrology without number resolving detectors*
   W.N. Plick, P.M. Anisimov, J.P. Dowling, Hwang Lee, G.S. Agarwal.
   New Journal of Physics **12**, 113025 (2010).

9. *Coherent-light boosted, super-sensitive, quantum interferometry*
   W.N. Plick, J.P. Dowling, G.S. Agarwal.
   New Journal of Physics **12**, 083014 (2010).

10. *Quantum metrology with two-mode squeezed vacuum: parity detection beats the Heisenberg Limit*
    P.M. Anisimov, G.M. Raterman, A. Chiruvelli, W.N. Plick, S.D. Huver, H. Lee, J.P. Dowling.
    Physical Review Letters **104**, 103602 (2010).

11. *Optimizing the multiphoton absorption properties of maximally path-entangled number states*
    W.N. Plick, C.F. Wildfeuer, P.M. Anisimov, and J.P. Dowling.
    Physical Review A **80**, 063825 (2009).
    Selected for the Virtual Journal of Quantum Information; Volume 9, Issue 12.

12. *Temperature dependence of molecular line strengths and Fe I 1565 nm Zeeman splitting in a sunspot*
    M.J. Penn, S. Walton, G. Chapman, J. Ceja, and W.N. Plick.
    Solar Physics **213**, 55 (2003).

Other Relevant Work:

1. *Supper-Sensitive Metrology Using Induced Coherence*
   N. Miller, S. Ramelow, and W.N. Plick.
   In Preparation.

2. *The Forgotten Quantum Number: A short note on the radial modes of Laguerre-Gauss beams*
   W.N. Plick, R. Lapkiewicz, S. Ramelow, and A. Zeilinger.
   Available at arXiv:1306.6517 (2013).

3. *Quantum Light for Quantum Technologies*
   W.N. Plick.
   PhD Thesis. Louisiana State University (2010). Winner of the 2011 Louisiana State University Distinguished Dissertation Award.

4. *Numerical Solutions to Gravitational Lensing*
   W.N. Plick.
   Undergraduate Senior Honors Thesis (2004). Available by request.

Grants and Awards

1. Dean's Summer Fellowship – Full summer funding for undergraduate researcher; won for three different students over several years (2017-2019).
2. SEED Grant for New Faculty – Partial internal funding of summer research (2017).
3. Louisiana State University Distinguished Dissertation Award – Yearly award with cash prize (2010).
4. Board of Regents Fellowship – Funded four years graduate education and research (2005).
5. Keck Fellowship – Funded a summer-long undergraduate research project (2003).

NB: I have done a number of other, larger grant applications (Marie Curie Fellowship, Newton Fellowship, ANR Retour Post-Doc, NSF QIS, and a DARPA YFA white paper) although most have received very-positive reviews, I have not been successful so far in getting such a grant, though I continue to apply.

Conference Presentations

1. *Super-sensitive Metrology using Induced Coherence* given at The APS March Meeting, March 7th, 2019.
2. Invited Speaker and Panelist at the *Emerging Trends in Nonlinear Optics Panel Discussion* during CLEO, May 17th, 2018.
3. *Physical meaning of the radial index of Laguerre-Gauss beams* given at CLEO, May 16th, 2017.
4. *Physical meaning of the radial index of Laguerre-Gauss beams* given at The APS March Meeting, March 17th, 2017.
5. *Extensions to the Wigner inequality for high-loss experimental scenarios* given at SPIE West OPTO, February 11th, 2015.
6. *The Forgotten Quantum Number: The Radial Modes of Laguerre-Gauss Beams* given in place of Prof. Anton Zeilinger at The APS March Meeting, March 7th, 2014.
7. *A Robust Bell Inequality Without Two-Outcome Measurements* given at the The APS March Meeting, March 6th, 2014.
8. *The Orbital Angular Momentum of Spatially Complex Modes* Invited Talk given at SPIE West OPTO, February 6th, 2013.
9. *Unique Properties and Prospects: Quantum Theory of the Orbital Angular Momentum of Ince-Gauss Beams* given at The APS March Meeting, March 1st, 2012.
10. *Coherent-Light Boosted, Super-Sensitive, Quantum Interferometry* given at DAMOP, May 29th, 2010.
11. *Coherent-Light Boosted, Super-Sensitive, Quantum Interferometry* given at SPIE West OPTO, January 28th, 2010. Listed as *Entanglement Boosted Bright-Source Interferometry.*
12. *A Study of the Absorption Properties of Maximally Path Entangled Number States* given at OSA, Laser Science, October 19th, 2008.

Contact Information

Home Address: 35 S. St. Clair Street Apt# 508, Dayton, OH, 45402.

Cellular Phone: (937) 347-7830.

Email Address: billplick@gmail.com.

Personal Professional Web-page: billplick.wordpress.com