

## JOSEPH S. CHOI, Ph.D.

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- I am passionate about solving big problems where optics, quantum physics, business, and data science intersect.
- Combining my training in experimental physics, optics, and software engineering, with my business acumen and analytical ability, I will bring new ideas and a unique perspective for solutions.
- With an appetite to constantly learn, I master new knowledge and skills by diving into the details as needed.

### Skills

- Proficient in C/C++, Fortran, database SQL, Matlab, Mathematica, CODE V.
- Some machine learning, data science, Python, HTML, CSS, JavaScript, PHP, SAS, R, CAD designs.
- Experimental expertise in UHV vacuum, cryogenics, atomic vapor cells, 3D light-field.
- Work expertise in business intelligence, internet marketing; fluent Korean.

### Research Experience

**University of Rochester** (Prof. John Howell) Sep. 2010 to present

- Quantum Optics experiments: Weak values interferometry, atomic prism, photonic crystals, vibration isolation.
- Quantum Information experiments: Utilized two-photon absorption with the optical Kerr effect, to explore cross-phase modulation enhancements using Rb atoms, optical cavity, and/or Gouy phase spatial effects.
- Invisibility: Achieved practical cloaking with off-the-shelf optics using optical engineering in [paraxial regime](#). Through 3D light-field sensing and 3D digital displays, extended to [omnidirectional cloak via discretization](#).

**Korea University** (Prof. Minhaeng Cho) Summer 2012

- Published theoretical [corrections to 'superchiral' fields](#) after studying semi-classical model of chiral molecules.

**Cornell University** (Prof. Georg Hoffstaetter) May 2004 to 2006

- Computationally simulated and analyzed electron beams for our Energy Recovery Linear Accelerator.

**Cornell University** (Prof. J.C. Seamus Davis) 2003 to 2004

- Built experiments for high-T<sub>c</sub> superconductors with Scanning Tunneling Microscopes in dilution refrigerators.

**Laboratory for Physical Sciences, Univ. of Maryland** (Prof. Keith Schwab) Summer 2001

- Helped Single Electron Transistor experiments in cryogenic lab w/ RF shielding for quantum computing.

**Brigham Young University** (Prof. David Allred) Apr. 2000 to Aug. 2001

- Led team of smart engineers; built ultrahigh vacuum chamber w/ thin film deposition and in situ ellipsometry.

### Work Experience

**Adobe Systems Incorporated** (Engineering Services Software Engineer) Jan. 2010 to Aug. 2010

- Worked directly with clients for customized coding and optimized solutions to our web analytics software.

**Choi Enterprise, LLC** (Internet Marketing Consultant) Apr. 2007 to Aug. 2010

- Consulted with clients on internet marketing (SEO, CPC, etc.), e-commerce, sales generation, and strategy.

**Xango LLC** (Report Analyst) Mar. 2008 to Apr. 2009

- Provided Business Intelligence reports, analytics, key performance indicators, dashboards to guide decisions.

**Nu Skin International** (Business Intelligence Analyst, Sales Representative) Nov. 2006 to Apr. 2008

- Provided and automated Business Intelligence reports, and analyses for corporate markets. Distributor orders.

**BoomYEAH, Inc.** (Corporate Vice-President) Jun. 2006 to Jun. 2007

- Helped start-up a visual online business directory- Immersed myself in marketing, sales, funding, finance, etc.

## Education

**The Institute of Optics, University of Rochester** Aug. 2010 to May 2016

- Degrees: PhD and MS in Optics, MS in Technical Entrepreneurship and Management. GPA: 3.93
- Honors: Robert L. and Mary L. Sproull Fellow, NSF IGERT Fellow, SPIE scholarships, APS scholarship. 2<sup>nd</sup> place in Data Science Competition (UP-STAT 2016, NY).
- Teaching: Built Bell's inequality entanglement experiment for Quantum Optics lab; TA for math methods.
- Courses: Quantum Optics (3 semesters), Fourier Optics, Nano-Optics, Lasers, Product Dev., Lens Design, etc.

**Cornell University** Aug. 2001 to May 2006

- Degree: MS in Physics (2005); PhD Candidate in Physics. GPA: 3.75
- Scholarships: SPIE, NSF summer research, Korean Consulate, Korean America Association.
- Teaching: TA for thermal physics, electromagnetism, and upper-level classical mechanics.
- Courses: Solid State Physics, Statistical Mechanics, Quantum Field Theory, Nonlinear Optics, General Relativity, Computational Physics, etc.

**Brigham Young University** Fall 1995, Summer 1998 to Aug. 2001

- Degree: BS in Mathematics, Physics (double major). GPA: 3.94
- Honors: Karl G. Maesar Scholar, University Honors, magna cum laude graduation, full-tuition scholarships.
- Courses: Computer programming, machine language, statistics, economics, technical writing, linear algebra, abstract algebra, topology, real analysis, complex analysis, multivariable calculus, number theory, etc.

## Community Involvement

**SPIE (International Society for Optics and Photonics)** 2010 to present

- *Conference Program Committee*: Novel Optical Systems Design and Optimization (Sep. 2015-).
- *Future Leaders Committee*: Provide input to board of directors for students, early career professionals (2016-).
- *Membership and Communities Committee*: Promote careers and needs of SPIE constituents (2016-).
- *Vice-President, member*: University of Rochester Student Chapter (VP: 2015-2016, member: 2010-2016).

**Senior Graduate Representative (The Institute of Optics)** 2013 to 2014

- Represent, actively address needs of graduate students to department, graduate committee, university.

**Habitat for Humanity** Jul. 2008 to Aug. 2010

- *Building Committee Manager (Volunteer)*: Coordinated building of homes for low-income families.

## Publications

- "[Digital integral cloaking](#)," J. Choi, J. Howell, *Optica* **3**, 536 (2016). ([video](#))
- "[Paraxial full-field cloaking](#)," J. Choi, J. Howell, *Optics Express* **23**, 15857 (2015).
- "[Paraxial ray optics cloaking](#)," J. Choi, J. Howell, *Optics Express* **22**, 29465 (2014). ([video](#))
- "[Amplitude-only, passive, broadband, optical spatial cloaking of very large objects](#)," J.C. Howell, J.B. Howell, J. Choi, *Applied Optics* **53**, 1958 (2014).
- "[Amplifications in chiroptical spectroscopy, optical enantioselectivity, and weak value measurement](#)," H. Rhee, J. Choi, D. Starling, J. Howell, M. Cho, *Chem.Sci.* **4**, 4107 (2013)
- "[Limitations of a superchiral field](#)," Joseph Choi, Minhaeng Cho, *Phys.Rev.A* **86**, 063834 (2012)
- "[Double Lorentzian atomic prism](#)," D. Starling, S. Bloch, P. Vudyaasetu, J. Choi, B. Little, J. Howell, *Phys. Rev. A* **86**, 023826 (2012).
- "[Emittance Dilution due to Transverse Coupler Kicks in the Cornell ERL](#)," B. Buckley, J. Choi, G.H. Hoffstaetter, *Report Cornell-ERL-06-02* (2006).
- "[Status of a Plan for an ERL Extension to CESR](#)," G.H. Hoffstaetter, J.S-H. Choi, et al., *Proceedings PAC05*, Knoxville/TN (2005).
- "[In Situ Ellipsometry of Surfaces in an Ultrahigh Vacuum Thin Film Deposition Chamber](#)," Joseph S. Choi, *University Honors Thesis, Brigham Young University* (2001).

## Patents

- **[3D Display Ray Principles and Methods, Zooming, and Real-time Demonstration](#)**: Joseph S. Choi and John C. Howell, U.S. Provisional Patent Application No. 62/378,016 (Filed: August 22, 2016; patent pending).
- **[Cloaking Systems and Methods](#)**: John C. Howell and Joseph S. Choi, PCT Application PCT/US2016/028665 (Filed: April 21, 2016; patent pending).
- **[Paraxial Cloak Design and Device](#)**: Joseph S. Choi and John C. Howell, U.S. Utility Patent Application 14/714,671 (Filed: May 18, 2015; patent pending).

## Presentations/Conferences

- **SPIE Optics and Photonics** (San Diego, CA): “[Digital integral cloaking](#)” oral presentation (August, 2016).
- **Adiabatic Quantum Computing Conference** (Venice, CA): “[Rudimentary binary classification for quantum machine learning](#)” poster (June, 2016).
- **UP-STAT 2016** (Buffalo, NY): [Data Science Competition finalist presentation](#) (April, 2016). (Placed 2<sup>nd</sup>.)
- **SPIE Optics and Photonics** (San Diego, CA): “[Paraxial cloaking](#)” poster (August, 2015).
- **AAPT Advanced Labs, Beyond First Year 2** (College Park, MD): Invited workshop to demonstrate and use [paraxial cloaking for beginner to advanced physics lab courses](#) (July, 2015).
- **Sci Foo 2015** (Google, Mountain View, CA): Informal “[camp](#)” for 250 invited science-related professionals, sponsored by Google, O’Reilly Media, Nature, and Digital Science (June, 2015).
- **APS DAMOP** (Columbus, OH): “[Paraxial full-field cloaking](#)” oral presentation (June, 2015).
- **SPIE Photonics West** (San Francisco, CA): “[Paraxial ray optics cloaking](#)” oral presentation; Edmund Optics exhibitor booth demonstration (Feb. 2015).
- **Tech+Forum** (Seoul, Korea): Among 6 invited speakers- “[How to cloak with rays of light.](#)” Public forum, sponsored by the Korean Ministry of Knowledge Economy (Nov. 20, 2014).
- **Energy for the 21st Century Symposium** (Rochester, NY): “[Overview of Possible Quantum Mechanics in Photosynthesis](#)” poster (Oct., 2011).

## Selected Media

- **Smithsonian Channel**: “[Could Star Trek’s Invisibility Cloak Become a Reality?](#)” (Sep. 4, 2016)
- **CNN**: “[Scientists get closer to creating real-life invisibility cloak](#)” (July 20, 2016)
- **OSA**: “[Researchers Turn an iPad Mini into an Invisibility Cloak](#)” (May 19, 2016)
- **NPR**: [Morning Edition](#) by Barry Gordemer (July 15, 2015)
- **Discovery Channel, Canada- Daily Planet**: [Invisibility Cloak](#) (March 18, 2015)
- **CNN**: [Experts invent invisibility cloak](#) (Jan. 7, 2015)
- **Arirang TV**: “[Heart to Heart](#)” talk show (Dec. 8, 2014)
- **Discovery News**: [The Invisibility Cloak You’ve Been Waiting For](#) (Sep. 29, 2014)
- **Time**: [This Discovery Brings Us One Step Closer to Harry Potter’s Invisibility Cloak](#) (Sep. 28, 2014)
- **Reuters**: [New York scientists unveil 'invisibility cloak' to rival Harry Potter's](#) (Sep. 26, 2014)
- **NBC News**: [Scientists Show You How to Make an Invisibility Cloak \(Sort Of\)](#) (Sep. 24, 2014)