

# TAEYOUNG CHOI

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## EDUCATION

Ph. D. in Physics, The Ohio State University, Columbus, USA, March 2011  
Specialization: Physics, Condensed Matter Experiment  
Advisor: Dr. Jay Gupta

Bachelor of Science in Physics (Cum Laude), Seoul National University,  
Seoul, South Korea, Feb 2004

## PROFESSIONAL EMPLOYMENT

Assistant Professor, Department of Physics, Ewha Womans University, Seoul, Republic of Korea (Mar 2017 – Present)

Post-doctoral Researcher, Nanoscale Studies at IBM Almaden Research Center, San Jose, CA, USA

Supervisor: Dr. Andreas Heinrich (Oct 2014 – Feb 2017)

- Design and build (<0.5 Kelvin and vector magnetic field 6T/5T) Scanning Tunneling Microscope
- The first measurement of electron paramagnetic resonance of individual magnetic atoms using STM (ESR-STM), improving 1000 times better in energy resolution (10neV)
- ESR-STM Quantum sensor using magnetic dipole-dipole interaction

Post-doctoral Researcher, Joint Quantum Institute, University of Maryland, College Park, MD, USA

Advisor: Prof. Chris Monroe (Sep 2011 – Sep 2014)

- Quantum entanglement of ultracold trapped ions in Atomic Molecular Optics
- Demonstrate multi-particle entanglement (>5 qubits) using programmable and local quantum gates

Graduate Research Associate, Department of Physics, The Ohio State University, Columbus, OH, USA

Advisor: Prof. Jay Gupta (Jan 2004 – Aug 2011)

- Spin excitation of magnetic atoms and molecules using STM at atomic scale
- Demonstrate single molecule Kondo switch and Build single atom-molecule magnets using atom manipulation

## AWARDS AND HONORS

- Presidential Fellow, The Ohio State University, Jan 2010 – Dec 2010
- Institute for Materials Research at OSU Poster Award, Sep 2010 and Sep 2008
- Clifford Heer Graduate Student Poster Award, May 2009
- Korea Institute for Advanced Study Best Presentation Award, Jan 2004
- University Scholarship, Seoul National University, 1997 – 1999

## INVITED TALKS

7. *44<sup>th</sup> Conference on the Physics & Chemistry of Surfaces & Interfaces (PCSI-44)*; Santa Fe, NM, USA (Jan 2017)

Title: “Magnetic dipole-dipole sensing at atomic scale using electron paramagnetic resonance STM”

6. *American Vacuum Society (AVS) 63<sup>rd</sup> International Symposium and Exhibition*; Nashville, TN, USA (Nov 2016)

Title: “Magnetic dipole-dipole sensing at atomic scale using electron paramagnetic resonance STM”

5. *Shared EPR (SPPI601)*; Hirschegg, Austria (Oct 2016)

Title: “Magnetic dipole-dipole sensing at the atomic scale using EPR-STM”

4. *598th WEH Seminar of Frontiers in Scanning Probe Microscopy*; Kiel, Germany (Nov 2015)

Title: “Magnetic dipole-dipole sensing at atomic scale using electron paramagnetic resonance STM”

3. *US-Korea Conference*; San Francisco, CA, USA (Aug 2014)  
Title: “Scalable Quantum computation and simulation in trapped ions using optimal Quantum control of multimode couplings”
2. *University of Maryland, College Park and NASA Joint seminar for AKPA (Association of Korean Physicist in America)*; College Park, MD, USA (Nov 2012)  
Title: “Ion trap Quantum Computation”
1. *University of Maryland and Joint Quantum Institute*; Maryland College Park, MD, USA (May 2011)  
Title: “STM studies of Electronic and Magnetic properties in Nanostructures – Toward Single Molecule Devices”

### COLLOQUIUM AND SEMINAR

9. *Ewha Womans University*; Seoul, Korea (June 2016)  
Title: “Coherent Quantum control and magnetism on atoms-trapped ion and ESR STM (Toward Quantum information processing)”
8. *Ewha Womans University*; Seoul, Korea (Jan 2016)  
Title: “Coherent Quantum control and magnetism on atoms-trapped ion and ESR STM (Toward Quantum information processing)”
7. *UNIST (Ulsan National Institute of Science and Technology)*; Ulsan, Korea (Nov 2015)  
Title: “Progress and vision of a new Quantum architecture using atoms on surfaces”
6. *Duke University, Department of Electrical Engineering*; Durham, NC, USA (July 2014)  
Title: “Studies of individual atoms in Scanning tunneling microscopy and trapped ion architecture toward nanoscale magnetism and scalable Quantum computation”
5. *IBM Almaden Research Center*; San Jose, CA, USA (June 2014)  
Title: “Scalable Quantum computation and simulation in trapped ions using optimal Quantum control of multimode couplings”
4. *IBM Almaden Research Center*; San Jose, CA, USA (Apr 2012)  
Title: “Ion qubit entanglement toward Quantum Computer”
3. *University of California Santa Barbara and California Nano Systems Institute*; Santa Barbara, CA, USA (May 2011)  
Title: “STM studies of Electronic and Magnetic properties in Nanostructures – Toward Single Molecule Devices”
2. *IBM Almaden Research Center*; San Jose, CA, USA (Feb 2011)  
Title: “Emergence of Electronic and Magnetic properties in Nanostructures – Toward Single Molecule Devices”
1. *24<sup>th</sup> Annual Edward F. Hayes Research Form, Ohio State University*; Columbus, OH, USA (May 2010)  
Title: “Toward Single Molecular Circuits – STM studies of single atoms and molecules”

### PUBLICATIONS IN REFEREED JOURNALS

- [14]. “Reading and writing single-atom magnets”  
F. Natterer, K. Yang, W. Paul, P. Willke, **T. Choi**, T. Greber, A.J. Heinrich, and C.P. Lutz, *accepted in Nature*.
- [13]. “Magnetic dipole-dipole sensing at atomic scale using electron paramagnetic resonance STM”  
**T. Choi**, W. Paul, S. Rolf-Pissarczyk, A. Macdonald, F. Natterer, K. Yang, P. Willke, C.P. Lutz, and A.J. Heinrich, *accepted in Nature Nanotechnology*.
- [12]. “Control of the millisecond spin lifetime of an electrically probed atom”  
W. Paul, K. Yang, S. Baumann, N. Romming, **T. Choi**, C.P. Lutz, and A.J. Heinrich, *Nature Physics* (2016), doi:10.1038/nphys3965.
- [11]. “Electron paramagnetic resonance in individual atoms on surfaces”  
S. Baumann\*, W. Paul\*, **T. Choi**, C.P. Lutz, A. Ardavan, and A.J. Heinrich, *Science* **350**, 417 (2015).
- [10]. “Building blocks for studies of nanoscale magnetism: adsorbates on ultrathin insulating Cu<sub>2</sub>N”  
**T. Choi** and J.A. Gupta,  
*Journal of Physics: Condensed Matter* **26**, 394009 (2014).
- [9]. “Optimal Quantum control on multi-mode coupling between trapped ion qubits for scalable entanglement”  
**T. Choi**, S. Debnath, T.A. Manning, C. Figgatt, Z.-X. Gong, L.-M. Duan, and C. Monroe,

Physical Review Letters **112**, 190502 (2014).

[8]. “Beat note stabilization of mode-locked lasers for quantum information processing”

R. Islam, W.C. Campbell, **T. Choi**, S.M. Clark, S. Debnath, E.E. Edwards, B. Fields, D. Hayes, D. Hucul, I.V. Inlek, K.G. Johnson, S. Korenblit, A. Lee, K.W. Lee, T.A. Manning, D.N. Matsukevich, J. Mizrahi, Q. Quraishi, C. Senko, J. Smith, and C. Monroe,  
Optics Letters **39**, 3238 (2014).

[7]. “Magnetism in single molecule/metal complexes formed by atom manipulation”

**T. Choi**, M. Badal, S. Loth, J.-W. Yoo, C.P. Lutz, A.J. Heinrich, A.J. Epstein, D.G. Stroud, and J.A. Gupta,  
Nano Letters **14**, 1196 (2014).

[6]. “Quantum Networks with Atoms and Photons”

C. Monroe, W.C. Campbell, C. Cao, **T. Choi**, S.M. Clark, S. Debnath, C. Figgatt, D. Hayes, D. Hucul, V. Inlek, R. Islam, S. Korenblit, K.G. Johnson, T.A. Manning, J. Mizrahi, B. Neyenhuis, A. Lee, P. Richerme, C. Senko, J. Smith, and K. Wright,  
Journal of Physics: Conference Series **467**, 012008 (2013).

[5]. “Emergence of surface states in nanoscale Cu<sub>2</sub>N islands”

C.D. Ruggiero, M. Badal, **T. Choi**, D. Gohlke, D.G. Stroud, and J.A. Gupta,  
Physical Review B **83**, 245430 (2011).

[4]. “Multistability in Charge-Transfer Complexes: Tetracyanoethylene on Cu(111)”

**T. Choi**, S. Bedwani, A. Rochefort, C.Y. Chen, A.J. Epstein, and J.A. Gupta,  
Nano letters **10**, 4175 (2010).

[3]. “Tunneling spectroscopy of ultrathin insulating Cu<sub>2</sub>N films, and single Co adatoms”

**T. Choi**, C.D. Ruggiero, and J.A. Gupta,  
Journal of Vacuum Science and Technology B **27**, 887 (2009).

[2]. “Incommensurability and atomic structure of c(2×2)N/Cu(100): A scanning tunneling microscopy study”

**T. Choi**, C.D. Ruggiero, and J.A. Gupta,  
Physical Review B **78**, 035430 (2008).

[1]. “Tunneling spectroscopy of ultrathin insulating films: CuN on Cu(100)”

C.D. Ruggiero, **T. Choi**, and J.A. Gupta,  
Applied Physics Letters **91**, 253106 (2007).

#### **PUBLICATIONS IN NON-REFEREED JOURNALS & ESSAYS**

[2]. “Entangling Trapped Ion Qubits for Quantum Computation”

**T. Choi**, AKPA (Association of Korean Physicist in America) Newsletter **29**, 3 (2013)

[1]. “Charge Transfer at the single Molecule Level- STM studies of organic-metal interface”

**T. Choi** and J.A. Gupta, Imaging & Microscopy **14**, 2 (2012)

#### **CONTRIBUTED PRESENTATIONS**

13. *Annual meeting of the American physical society (March meeting)*; Baltimore, USA (Mar 2016)

Title: “Magnetic dipole-dipole sensing at the atomic scale using ESR-STM”

12. *American Vacuum Society (AVS) 62<sup>nd</sup> International Symposium and Exhibition*; San Jose, CA, USA (Oct 2015)

Title: “Kelvin Probe Force Microscopy studies of magnetic atoms on ultrathin insulating MgO film”

11. *8<sup>th</sup> International Conference on Physics and Applications of Spin-Related Phenomena in Solids*; Washington DC, USA (July 2014)

Title: “STM studies of individual hybrid inorganic-organic molecular magnets on an ultrathin insulating film”

10. *Workshop of Modular Universal Scalable Ion-trap Quantum Computer program*; Durham, NC, USA (Aug 2013)

Title: “MS (Molmer-Sorenson) Quantum entangling gate in a chain using multi-segmented pulses”

9. *Workshop of Modular Universal Scalable Ion-trap Quantum Computer program*; Ann Arbor, MI, USA (Mar 2012)

Title: “Entanglement of ions in a chain using individual addressing and pulse shaping toward high fidelity and faster gate”

8. *Annual meeting of the American physical society (March meeting)*; Dallas, USA (Mar 2011)

Title: “Charge transport through single alkanedithiol molecules on an ultrathin insulating film: Influence on an atomic Kondo resonance”

7. *18<sup>th</sup> International Vacuum Congress*; Beijing, China (Aug 2010)

Title: “STM studies of single organic magnets on metal and insulating surfaces”

6. *SPSTM 3 (Spin-Polarized Scanning Tunneling Microscopy) International Conference*; Seoul, Korea (Aug 2010)

Title: “STM studies of single organic magnets on metal and insulating surfaces”

5. *52<sup>nd</sup> Electronic Materials Conference*; Notre Dame, USA (June 2010)

Title: “STM studies of hybrid inorganic-organic molecular magnets on an ultrathin insulating film”

4. *Annual meeting of the American physical society (March meeting)*; Portland, USA (Mar 2010)

Title: “STM studies of hybrid inorganic-organic molecular magnets on an ultrathin insulating film”

3. *Annual meeting of the American physical society (March meeting)*; Pittsburgh, USA (Mar 2009)

Title: “Reversible switching of charge states of single TCNE molecules on Cu(111)”

2. *NSS5(Nanoscale spectroscopy and nanotechnology) – SPSTM2 (Spin-polarized scanning tunneling microscopy) joint international conference*; Athens, USA (July 2008)

Title: “STM studies of transport through single azobenzene molecules”

1. *Annual meeting of the American physical society (March meeting)*; Louisiana, USA (Mar 2008)

Title: “STM studies of transport through single azobenzene molecules”

## **MEMBERSHIPS**

- American Physical Society, 2008 – Present

## **JOURNAL REVIEW**

- Physical Review Letters, Nature Communication, Journal of Physical Chemistry Letters, Journal of the Optical Society of America B

## **LANGUAGES**

- English: Fluent in speaking, reading, and writing
- Korean: Native language

## **TEACHING EXPERIENCE**

- Teaching Assistant, Physics 133: “Waves”, Ohio State University, Spring 2007
- Teaching Assistant, Physics 111: “General Physics: Mechanics and Heat”, Ohio State University, 2005 – 2006