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# Dr. Ahn, Kwang Jun

## Research Topics and Interest

**Quantum Optics:** Light-Matter Interaction and Ultrafast electron dynamics in low dimensional metals and semiconductors, Quantum plasmonics.

**Classical Optics:** Nonlinear Surface Plasmon, Terahertz optics, Near-field optics, Metamaterials.

**Theory:** Density matrix formalism in 2nd quantizations, Finite difference time domain (FDTD), finite element (FEM), coupled dipole (CDM) methods with Green functions.

## RESEARCH AND PROFESSIONAL EXPERIENCES

**Apr 2014 - now** Associate Research Professor, Department of Energy Systems Research, Ajou University.

**Aug 2012 - Feb 2014** Contract Research Assistant Professor, Global Frontier Center for Multiscale Energy Systems, Seoul National University.

**Sep 2008 - July 2012** Contract Research Assistant Professor, BK21 Frontier Physics Research Division of Seoul National University, Lectures: Electrodynamics, Fundamental Physics, Selected Topics in Solid State Physics (graduate school).

**May 2009 - Apr 2011** Research project funded by Korean ministry of education and science for 2 years, **High efficient solar cell design using quantum dots and surface plasmon**, 98,798,000 KW)

**Sep 2006 - Aug 2008** Postdoctorial researcher, BK21 Frontier Physics Research Division of Seoul National University.

**Oct 2002 - Mar 2006:** Research assistant , Collaborative research center 296 (**Growth correlated properties of low-dimensional semiconductor structures**) Subdivision B14: **Ultrafast nonlinear optics of interacting quantum dots**.

Teaching assistant: Diplom thesis attendance, Preparation of lecture materials
F. Milde, *On the Quantum Theory of Light Emission of Coupled Electron-Phonon Excitations in Semiconductor Quantum Dots*, Physics, Technical University Berlin (TUB), Aug 2005.
E. Malic, *Dynamic Theory of Quantum Dot Semiconductor Lasers*, Physics, TUB, Sep 2005.
S. Ritter, *Theory of Excitation Energy Transfer between Coupled Semiconductor Quantum Dots*, Physics, TUB, May 2006.

**Jan 2004 - Jul 2004:** Project: *Optical Response of Semiconductor Quantum Dots interacting with metallic nanostructures*, Cooperation with the Optical Science Center, University of Arizona, Tucson, USA.

## EDUCATION

**Oct 2002-Feb 2006:** **Dr.rer.nat.**, Physics, Technische Universität Berlin (Technical University Berlin, Germany)
thesis: Fully quantum mechanical description of ultrashort time dynamics of semiconductor quantum dots, note: very good.

**Oct 1996-Sep 2002:** **Diplom Physiker (B.Sc and M.Sc)**, Physics, Technische Universität Berlin (Technical University Berlin, Germany)
thesis: Theory of near-field optics of semiconductor quantum structures, note: very good.

**Oct 1995-Sep 1996:** Electronic Engineering , Technische Universität Berlin (Technical University Berlin, Germany) .

**Mar 1989-Feb 1995:** **B.Sc.**, Electronic Engineering, Myong-Ji University, Seoul, Korea, note:3.69/4.5.
(Apr 1991-Oct 1992 military service in army)

## SKILLS

**Language:** German, English

**Computer:** C, C++, Fortran, Python, Parallel Processing Programming, FDTD, Linux, Latex, Windows.

## References

**Prof.Dr. Andreas Knorr** Institute for Theoretical Physics EW7-1, Technische Universität Berlin, Hardenbergstr. 36, 10623 Berlin, Germany, email: Andreas.Knorr@physik.tu-berlin.de, phone: +49-30-314-24255

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**Prof.Dr. Park, Namkyoo** School of EECS Seoul National University Seoul, Korea 151-742, email:nkpark@snu.ac.kr, phone:+82-2-880-1820

# Publications

## *Articles (_* as a first or a corresponding author)*

**Jan. 2015:** 47. Jun Wan Kim, Sun Young Choi, Shanmugam Aravazhi, Markus Pollnau, Uwe Griebner, Valentin Petrov, Sukang Bae, Kwang Jun Ahn, Dong-Il Yeom, and Fabian Rotermund, *Graphene Q-switched Yb:KYW planar waveguide laser*, AIP Adv. **5**, 017110.

**Aug. 2014:** 46. Young-Mi Bahk, Gopakumar Ramakrishnan, Jongho Choi, Hyelynn Song, Geunchang Choi, Yong Hyup Kim, Kwang Jun Ahn, Dai-Sik Kim, and Paul C. M. Planken, *Plasmon Enhanced Terahertz Emission from Single Layer Graphene*, ACS Nano **8**, 9089.

**May. 2014:** 45. Kyungyeon Ha, Hoseop Choi, Kinam Jung, Kyuhee Han, Jong-Kwon Lee, KwangJun Ahn,and Mansoo Choi, *Large-area assembly of three-dimensional nanoparticle structures via ion assisted aerosol lithography with a multi-pin spark discharge generator*, Nanotechnology, **25**, 225302.

**Apr. 2014:** 44. Kinam Jung, Jungsuk Hahn, Sungjun In, Yongjun Bae, Heechul Lee, Peter V. Pikhitsa, Kwangjun Ahn, Kyungyeon Ha, Junhoi Kim, Jong-Kwon Lee, Sunghoon Kwon, Namkyoo Park and Mansoo Choi, *Hot-spots Engineered 3D Multipetal Flower Assemblies for Surface-Enhanced Raman Spectroscopy*, Advanced Materials, **26**, 5924.

**Feb. 2014:** 43. Kinam Jung, Hyung-Jun Song, Gunhee Lee, Youngjun Ko, Kwangjun Ahn, Hoseop Choi, Jun Young Kim, Kyungyeon Ha Jiyun Song, Jong-Kwon Lee, Changhee Lee, Mansoo Choi, *Plasmonic Organic Solar Cells Employing Nanobump Assembly via Aerosol-Derived Nanoparticles*, ACS Nano **8**, 2590.

**Sep. 2013:** 42. S. H. Kim, C. M. Lee, K. J. Ahn, and K. J. Yee, *Coupling of air/metal and substrate/metal surface plasmon polaritons in Au slit arrays fabricated on quartz substrate*, Optics Express **21**, 21871.

41. Xiaoshu Chen, Hyeong-Ryeol Park, Matthew Pelton, Xianji Piao, Nathan C. Lindquist, Hyungsoon Im, Yun Jung Kim, Jae Sung Ahn, Kwang Jun Ahn, Namkyoo Park, Dai-Sik Kim, and Sang-Hyun Oh, *Atomic layer lithography of wafer-scale nanogap arrays for extreme confinement of electromagnetic waves*, Nature Communications **4**, 2361.

**Jul. 2013:** 40. S. H. Kim, C. M. Lee, D. W. Park, S. K. Noh, S. B. Sim, J. Kim, G. H. Kim, K. J. Ahn, D. S. Kim, K. J. Yee, *Evolution of surface plasmon resonance with slab thickness in hybrid nano-structures of Au/InGaAs slab waveguide*, Applied Physics B, DOI 10.1007/s00340-013-5575-2.

**May. 2013:** 39. I. H. Baek, K. J. Ahn, B. J. Kang, S. Bae, B. H. Hong, D.-I. Yeom, K. Lee, Y. U. Jeong, and F. Rotermund, *Terahertz transmission and sheet conductivity of randomly stacked multilayer graphene*, Applied Physics Letters, **102**, 191108.

**Feb. 2013:** 38. Hyeong-Ryeol Park, Kwang Jun Ahn, Sanghoon Han, Young-Mi Bahk, Namkyoo Park, and Dai-Sik Kim, *Colossal Absorption of Molecules Inside Single Terahertz Nanoantennas*, Nano Letters, **13**, 1782.

37. Hyun Woo Kihm, Jineun Kim, Sukmo Koo, Jaesung Ahn, Kwangjun Ahn, Kwanggeol Lee, Namkyoo Park, and Dai-Sik Kim, *Optical magnetic field mapping using a subwavelength aperture*, Optics Express **21**, 5625.

**Dec. 2012:** 36. D.J. Park, J.T. Hong, J.K. Park, S.B. Choi, B.H. Son, F. Rotermund, S. Lee, K.J. Ahn, D.S. Kim, and Y.H. Ahn, *Resonant transmission of terahertz waves through metallic slot antennas on various dielectric substrates*, Current Applied Physics **13**, 753.

**Oct. 2012:** 35. Young-Mi Bahk, Jae-Wook Choi, Jisoo Kyoung, Hyeong-Ryeol Park, Kwang Jun Ahn, and Dai-Sik Kim, *Selective enhanced resonances of two asymmetric terahertz nano resonators*, Optics Express **20**, 25644.

**Mar 2012:** 34. Seung Hyun Kim, Chung Min Lee, Seung Bo Sim, Jin hee Kim, Jang hee Choi, Won Seok Han, Kwang Jun Ahn*, and Ki Ju Yee, *Enhanced in and out-coupling of InGaAs slab waveguides by periodic metal slit arrays*, Optics Express **20**, 6365.

**Nov. 2011:** 33. Hyeong-Ryeol Park, Young-Mi Bahk, Jong Ho Choe, Sanghoon Han, Seong Soo Choi, Kwang Jun Ahn, Namkyoo Park, Q-Han Park, and Dai-Sik Kim, *Terahertz pinch harmonics enabled by single nano rods*, Optics Express **19**, 24775.

**Oct 2011:** 32. Young-Gyun Jeong, Hannes Bernien, Ji-Soo Kyoung, Hyeong-Ryeol Park, Hyun-Sun Kim, Jae-Wook Choi, Bong-Jun Kim, Hyun-Tak Kim, Kwang Jun Ahn, and Dai-Sik Kim, *Electrical control of terahertz nano antennas on $VO_2$ thin film*, Optics Express **19**, 21211.

## Publications (suite)

31. K. J. Ahn*, S. W. Hwang, D. H. Shin, C. O. Kim, S. H. Hong, M. C. Kim, J. Kim, L. Y. Lim, S. Kim, , S.-H. Choi, G. Kim, S. H. Sim, and B. H. Hong, *Reply to Comment on Ref.26*, Physical Review Letters **107**, 159702.

**Sep 2011:** 30. Hyeong-Ryeol Park, Young-Mi Bahk, Kwang Jun Ahn, Q-Han Park, Dai-Sik Kim, Luis Martin-Moreno, Francisco J. Garcia-Vidal, and Jorge Bravo-Abad, *Controlling terahertz radiation with nanoscale metal barriers embedded in slot antennas*, ACS Nano **5**, 8340.

**Feb 2011:** 29. S. B. Choi, Jisoo Kyoung, H. S. Kim, H. R. Park, D. J. Park, Bong-Jun Kim, Y. H. Ahn, Fabian Rotemund, Hyun-Tak Kim, K. J. Ahn, and D. S. Kim, *Nano Pattern Enabled Terahertz All-optical Switching on Vanadium Dioxide Thin Film*, Applied Physics Letters **98**, 071105.

**Jan 2011:** 28. Y. M. Bahk, H. R. Park, K. J. Ahn, H. S. Kim, Y. H. Ahn, Dai-Sik Kim, J. Bravo-Abad, L. Martin-Moreno, and F. J. Garcia-Vidal, *Anomalous Band Formation in Arrays of Terahertz Nanoresonators*, Physical Review Letters **106**, 013902.

27. J. S. Kyoung, M. A. Seo, S. M. Koo, H. R. Park, H. S. Kim, B. J. Kim, H. T. Kim, N. K. Park, D. S. Kim, and K. J. Ahn*, *Active Terahertz Metamaterials: Nano-slot antennas on $VO_2$ thin films*, Physica Status Solidi (c), **8**, 1227.

**Sep 2010:** 26. Sung Won Hwang, Dong Hee Shin, Chang Oh Kim, Seung Hui Hong, Min Choul Kim, Jungkil Kim, Keun Yong Lim, Sung Kim, Suk-Ho Choi, Kwang Jun Ahn, Gunn Kim, Sung Hyun Sim, and Byung Hee Hong, *Plasmon-enhanced ultraviolet photoluminescence from hybrid structures of graphene/ZnO films*, Physical Review Letters **105**, 127403.

**Aug 2010:** 25. J. S. Kyoung, M. A. Seo, H. R. Park, K. J. Ahn, and D. S. Kim, *Far Field Detection of Terahertz Near Field Enhancement of Sub-Wavelength Slits using Kirchhoff Integral Formalism*, Optics Communications, **283**, 4907.

**Jul 2010:** 24. Jisoo Kyoung, Minah Seo, Hyeongryeol Park, Sukmo Koo, Hyun-sun Kim, Youngmi Park, Bong Jun Kim, Kwangjun Ahn, Namkyoo Park, Hyun-Tak Kim, and Dai-Sik Kim, *Giant nonlinear response of terahertz nanoresonators on $VO_2$ thin film*, Optics Express **18**, 16452.

23. Hyun-woo Kihm, Q. H. Kim, D. S. Kim, and K. J. Ahn*, *Phase-sensitive imaging of diffracted light by single nanoslits: measurements from near to far field*, Optics Express **18**, 15725.

**May 2010:** 22. Minah Seo, Jisoo Kyoung,Hyeongryeol Park, Sukmo Koo, Hyun-sun Kim, Hannes Bernien, Bong Jun Kim, Jong Ho Choe, Yeong Hwan Ahn, Hyun-Tak Kim, Namkyoo Park, Q-Han Park, Kwangjun Ahn*, and Dai-sik Kim*, *Active Terahertz Nanoantennas Based on $VO_2$ Phase Transition*, Nano Letters **10**, 2064.

21. H. R. Park, S. M. Koo, O. K. Suwal, Y. M. Park, J. S. Kyoung, M. A. Seo, S. S. Choi, N. K. Park, D. S. Kim, and K. J. Ahn*, *Resonance behavior of single ultrathin slot antennas on finite dielectric substrates in terahertz regime*, Applied Physics Letters **96**, 211109.

**Mar 2010** 20. H. R. Park, Y. M. Park, H. S. Kim, J. S. Kyoung, M. A. Seo, D. J. Park, Y. H. Ahn, K. J. Ahn, and D. S. Kim, *Terahertz nanoresonators: Giant field enhancement and ultrabroadband performance*, Applied Physics Letters **96**, 121106.

**Jul 2009** 19. H. W. Khim, K. G. Lee, D. S. Kim, and K. J. Ahn*, *Dual mode near-field scanning optical microscopy for near-field imaging of surface plasmon polariton*, Optics Communications **282**, 2442.

**Apr 2009** 18. H. W. Kihm, J. H. Kang, J. S. Kyoung, K. G. Lee, M. A. Seo, and K. J. Ahn*, *Separation of surface plasmon polariton from nonconfined cylindrical wave launched from single slits*, Applied Physics Letters **94**, 141102.

**Nov 2008** 17. M. A. Seo, A. J. L. Adam, J. H. Kang, J. W. Lee, K. J. Ahn, Q. H. Park, P. C. M. Planken, and D.S. Kim, *Near field imaging of terahertz focusing onto rectangular apertures*, Optics Express **16**, 20484.

**Oct 2008:** 16. K J Ahn*, K G Lee, H W Kihm, M A Seo, A J L Adam, P C M Planken, and D S Kim, *Optical and terahertz near-field studies of surface plasmons in subwavelength metallic slits*, New Journal of Physics **10**, 105003.

**Aug 2008:** 15. K. G. Lee, K. J. Ahn, H. W. Khim, J. S. Ahn, and D. S. Kim, *Surface plasmon polariton detection discriminating polarization-dependent image dipole effects*, Proc. SPIE **7033**, 70331B.

14. H. W. Khim, K. G. Lee, M. A. Seo, K. J. Ahn, A. J. L. Adam, J. H. Kang, Q. H. Park, P. C. M. Planken, and D. S. Kim, *Near-field studies of surface plasmon generation: optical and terahertz studies*, Proc. SPIE **7032**, 70321P.

## Publications (suite)

**Jul 2008:** 13. K. G. Lee, K. J. Ahn, H. W. Kihm, J. S. Ahn, T. K. Kim, S. Hong, Z. H. Kim, and D. S. Kim, *Surface plasmon polariton detection discriminating the polarization reversal image dipole effects*, Optics Express **16**, 10641.

**May 2008:** 12. A. J. L. Adam, J. M. Brok, M. A. Seo, K. J. Ahn, D.S. Kim, J.H. Kang, Q. H. Park, M. Nagel, and P. C. M. Planken, *Advanced terahertz electric near-field measurements at sub-wavelength diameter metallic apertures*, Optics Express **16**, 7407.

**Apr 2008:** 11. K. J. Ahn*, K. G. Lee, and D. S. Kim, *Effect of dielectric interface on vector field mapping using gold nanoparticles as a local probe: Theory and experiment*, Optics Communications **281**, 4136.

**Mar 2008:** 10. D. J. Park, S. B. Choi, K. J. Ahn, D. S. Kim, J. H, Kang, Q-Han Park, M. S. Jeong, and D.-K. Ko, *Experimental verification of surface plasmon amplification on a metallic transmission grating*, Physical Review B **77**, 115451.

**Oct 2007:** 9. K. G. Lee, H. W. Kihm, K. J. Ahn, J. S. Ahn, Y. D. Suh, C. Lienau, and D. S. Kim, *Vector field mapping of local polarization using gold nanoparticle functionalized tips: independence of the tip shape*, Optics Express **15**, 14993.

**Jan 2007:** 8. K. J. Ahn*, F. Milde, and A. Knorr, *Phonon-Wave-Induced Resonance Fluorescence in Semiconductor Nanostructures: Acoustoluminescence in the Terahertz Range*, Physical Review Letter **98**, 027401.

**Sep 2006** 7. E. Malic K. J. Ahn, M. J. P. Bormann, P. Hövel, E. Schöll, A. Knorr M. Kuntz, and D. Bimberg, *Theory of relaxation oscillations in semiconductor quantum dot lasers*, Applied Physics Letter **89**, 101107.

**Jul 2006:** 6. F. Milde, K. J. Ahn, and A. Knorr *Theory of quantum dot luminescence from acoustically excited intersubband transitions*, Physica Status Solidi (b) **243**, 2257.

5. M. Richter, K. J. Ahn, A. Knorr, A. Schliwa, D. Bimberg, M. E. Madjet, and T. Renger, *Theory of Excitation Transfer in Coupled Nanostructures - From Quantum Dots to Light Harvesting Complexes*, Physica Status Solidi (b) **243**, 2302.

**Apr 2006:** 4. J. Danckwerts, K. J. Ahn, and A. Knorr, *Theory of ultrafast nonlinear optics of Coulomb-coupled Semiconductor Quantum Dots: Rabi-Oscillations and Pump-Probe Spectra*, Physical Review B **73**, 165318.

**Apr 2005:** 3. Kwang Jun Ahn*, Jens Förstner, and Andreas Knorr, *Resonance Fluorescence of Semiconductor Quantum Dots: Signature of Electron-Phonon Interaction*, Physical Review B **71**, 153309.

**Sep 2003:** 2. Kwang Jun Ahn* and Andreas Knorr, *Radiative Lifetime of Quantum Confined Excitons near Interface*, Physical Review B **68**, 161307(R).

**Jul 2002:** 1. J. Förstner, K. J. Ahn, J. Danckwerts, M. Schaarschmidt, I. Waldmüller, C. Weber, and A. Knorr, *Light Propagation and Many-particle-induced Non-Lorentzian Lineshapes in Semiconductor Nanooptics*, Physica Status Solidi (b) **234**, 155.

### *Conferences and Invited Talks*

**Aug 2013:** Invited Seminar, *Lasing SPASER from Metal Slit Arrays on InGaAs Slabs*, Dep. Physics, Hanyang University, Seoul, Korea.

**May 2012:** Advanced Lasers and their applications 2012, *Enhanced in- and out-coupling of InGaAs slab waveguides by periodic metal slit arrays*, jeju, Korea.

**Oct 2011** 7th Korean-German/6th Korean-Frech Workshop on Nanophotonics and Spintronics, *Optical Properties of Semiconductors Strongly Interacting with Surface Plasmon*, Kloster Bronnbach, Germany.

**Feb 2011** 2011 Green Technology Forum, *High efficient solar cell design using quantum dots and surface plasmon*, Jeju Lotte Hotel, Jeju, Korea.

**Oct 2010** Invited Seminar at Science Touch on Friday, *Mapping of swirling Electromagnetic Fields of Light*, Pusan, Korea

6th Korean-German Nano-photonics Workshop, *Tailoring Optical Properties of Nanoresonators in Terahertz Frequency Regime*, Baekdam Temple, Korea

## Publications (suite)

**Sep 2010:** IRMMW-THz 2010, *1. Tight-binding description of transmission through crowded terahertz nanoresonators*, *2. Resonance frequency shifts of rectangular holes on finite dielectric substrates*, *3. Ultrabroadband Metamaterial with full transmission control*, 4. Pinch harmonic analogue of terahertz nanoresonator control using metal nano-rods, Rome, Italy

**Aug 2010:** 10th Nonlinear Optics and Excitation Kinetics in Semiconductors, *Active Terahertz Metamaterials: Nano-slot antennas on $VO_2$ thin films*, Paderborn, Germany

**May 2010:** Invited Seminar, *Plasmonics in Optical and THz Frequency Regimes*, Dep. Applied Physics, Kyung Hee University, Korea.

**Nov 2009:** The 7th Asia-pacific conference on near-field optics, *Near-field investigation of interference pattern formed by surface plasmon standing wave and direct transmitted light*, Jeju, Korea

**May 2009:** Advanced Lasers and their applications 2009, *Near-field studies using coupled dipoles and finite element methods*, Jeju, Korea

**Dec 2008:** Invited Seminar, *Quantum-Confined Electron Dynamics and Manipulation of Optical Properties of Semiconductor Quantum Dots*, Korea Institute of Science and Technology, Korea.

**Sep 2008:** IRMMW-THz 2008, *Vector Field Mapping of THz-Electromagnetic Wave Transmitted Through Quadruple Holes*, USA

International conference on near-field optics, nanophotonics, and related techniques 2008, *Influence of the reflected field from interfaces on near-field detections with gold nanoparticles as a local probe*, Argentina

**Aug 2008:** SPIE 2008,*Surface plasmon polariton detection discriminating polarization-dependent image dipole effects*, USA

SPIE 2008,*Near-field studies of surface plasmon generation: optical and terahertz studies*, USA

**Nov 2007:** Invited Seminar, *Nanooptics: Designed Coupling of Nanostructures with Light*, Dep. of Physics, Inha University, Korea

**Oct 2007:** Annual meeting of The Korean Physical Society 2007, *Theory of Evanescent Field Detection using Gold Nanoparticles above Dielectric Surfaces*, Jeju, Korea

**Jan 2007:** Workshop for Quantum Optics 2007, *Raster-Scanning Vector Image of Surface Plasmon Polariton: Toward Manipulating Image Charge Effects*, Muju, Korea.

**Feb 2006:** 8th International Workshop on Nonlinear Optics and Excitation Kinetics in Semiconductors (NOEKS), *Theory of quantum dot luminescence from acoustically excited intersubband transitions*, Münster, Germany

NOEKS, *Theory of Excitation Transfer in Coupled Nanostructures-From Quantum Dots to Light Harvesting Complexes*, Münster, Germany

**May 2005:** CLEO, *Nonlinear Optical Response of Two Coupled Semiconductor Quantum Dots: Differential Transmission Spectra*, Baltimore USA.

**Mar 2005:** Annual Meeting of German Physical Society, *Resonance Fluorescence and Squeezing of Semiconductor Quantum Dots: Signature of Electron-Phonon Interaction*, Berlin Germany.

**Sep 2004:** The 8th International Conference on Near-Field Nano Optics & Related Techniques, *Quantum Theory of the Resonance Fluorescence of Quantum Dots Excitons Interacting with Acoustic Phonons*, Seoul Korea.

**Mar 2003:** Annual meeting of German physical society, *Radiative Lifetime of Quantum Confined Excitons near Interface*, Dresden Germany.

First German-Japanese Symposium on Spatially Resolved Spectroscopy and Fabrication of Nano-Structures for Nano-Atom, Photonics, *Radiative Lifetime of Quantum Confined Excitons near Interface*, Berlin Germany.