

EFTHYMIOS KALLOS (CV)

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Research Interests

- Electromagnetics; Antennas; Optics; FDTD; Metamaterials; Nonlinear Interactions; Lasers.
- High Energy Physics; Particle Accelerators; Laser- and beam-plasma interactions; Radiation sources; Particle in Cell Simulation Codes.

Professional & Research Experience

- QUEEN MARY UNIVERSITY OF LONDON (QMUL), London, UK 2008 – now
Post-Doctoral Researcher – *School of Electronic Engineering and Computer Science*
Projects: Analysis of metamaterial-based electromagnetic cloaking devices. Focus on broadband responses of materials, FDTD simulations and all-dielectric cloaks. Experience on absorbers and wave effects in cylindrical symmetrical devices.
Mentor: Prof. Yang Hao
- BROOKHAVEN NATIONAL LABORATORY (BNL), Upton, NY 2004 – 2008
Researcher – *Accelerator Test Facility (ATF)*
Projects: I planned, analyzed and tested a number of experiments examining various advanced accelerator schemes using plasmas. We demonstrated the first high-gradient acceleration of a trailing electron bunch in a plasma. Experience on various lasers (interferometry, Free electron laser), plasma sources (ablative and gas-filled capillaries) and extensive spectroscopic measurements & diagnostics.
Mentor: Dr. Vitaly Yakimenko
- UNIVERSITY OF SOUTHERN CALIFORNIA (USC), Los Angeles, CA 2004 – 2008
Research Assistant – *Plasma Accelerator Group*
Projects: Extensive data analysis of various plasma wakefield experiments conducted at ATF. Developed numerical solvers in Matlab for systems of partial differential equations and beam-plasma interactions (themOsiris code). Analyzed theoretically efficiency enhancement techniques for advanced particle accelerators. Simulated various plasma acceleration schemes using fully explicit 3D particle-in-cell simulations in Osiris.
Mentors: Prof. Tom Katsouleas & Prof. Patric Muggli
- UNIVERSITY OF SOUTHERN CALIFORNIA (USC), USA 2006 – 2008
Research Assistant – *Pulsed Power Laboratory*
Project: Designed, constructed and diagnosed gas-filled glass capillary plasma sources. Examined and tested the stability and dependence of plasma density on capillary length, diameter, applied voltage, gas pressure and electrode size over a wide range of densities.
- NATIONAL TECHNICAL UNIVERSITY OF ATHENS (NTUA), Greece 2002 – 2003
Undergraduate Research Assistant – *Microwaves and fiber optics telecommunications laboratory*
Project: Analyzed theoretically and simulated in Matlab the electromagnetic wave propagation in various dielectric and metal waveguides.

Education

- UNIVERSITY OF SOUTHERN CALIFORNIA (USC), Los Angeles, CA 2005 – 2008
Department of Electrical Engineering
Ph.D. in Electrical Engineering (expected August 2008). Thesis title: “Plasma Wakefield Accelerators using Multiple Electron Bunches”. The work analyzes in detail both experimentally and theoretically the possibility of utilizing multiple electron bunches in order to drive a plasma wakefield particle accelerator. Those schemes are important for the design of a future particle collider.
Advisor: Prof. Tom Katsouleas
- UNIVERSITY OF SOUTHERN CALIFORNIA (USC), Los Angeles, CA 2003 – 2005
Department of Electrical Engineering
Master of Science in Electrical Engineering. GPA: 3.85/4.00. Coursework and projects focused on advanced electromagnetic theory, optics, antenna design, optical communications, semiconductor photonics and plasmas.
Advisor: Prof. Tom Katsouleas
- NATIONAL TECHNICAL UNIVERSITY OF ATHENS (NTUA), Athens, Greece 1998 – 2003
Department of Electrical Engineering and Computer Science
Diploma in Electrical and Computer Engineering. GPA: 9.1/10 (Top 3%). 5 year program. Specialization in the area of telecommunications. Thesis title: “Study of the Smith-Purcell effect in dielectric corrugated waveguides”. The work examines the properties of the radiation emitted when a charged particle beam propagates parallel to a periodic dielectric waveguide. The propagation characteristics of the system are modeled in Matlab.
Advisor: Prof. Nikolaos Uzunoglu
- U.S. PARTICLE ACCELERATOR SCHOOL (USPAS), Ithaca, NY June 2005
Cornell University
Introduction to Particle Physics and Accelerators (graduate level courses).
Instructor: Prof. Waldo McKay

Teaching Experience

- **Part-time Instructor & Teaching Assistant** Fall 2004 – Fall 2006
Course EE105: Introduction to Electrical Engineering, Electrical Engineering Department, USC
I was invited to give lectures and prepare homeworks relating to lasers, scanning electron microscopes and computer networks. I also aided in the construction and testing of computer-controlled robots from the students (class project).
- **Teaching Assistant** Spring 2004
Course EE326: Essentials of Electrical Engineering, Electrical Engineering Department, USC
I was overseeing an electrical engineering laboratory where biomedical engineering students were experimenting with various EE projects. I taught the project material during each session and also held discussion sessions.
- **Laboratory Assistant** Fall 2003 – Spring 2004
Course EE202: Linear Circuits Laboratory, Electrical Engineering Department, USC

I was responsible for teaching and explaining various circuit theory principles to two student sessions, along with helping them with laboratory demonstration of electrical circuit projects.

Conference & Seminar Talks

- “Experimental results of a plasma wakefield accelerator using multiple bunches” *June 2008*
European Particle Accelerator Conference (EPAC08), Genoa, Italy
- “Dark Matter Evidence through Gravitational Lensing and WMAP Data” *Jan 2008*
Research Group Seminar, University of Southern California, Los Angeles, CA
- “Plasma wakefield accelerators using multiple bunches” *June 2007*
Electrical Engineering Department Seminar, University of Southern California, Los Angeles, CA
- “Multibunch plasma wakefield experiments at ATF” *July 2006*
American Physical Society 12th Advanced Accelerator Concepts Workshop (AAC06), Lake Geneva, WI
- “Design, analysis and construction of living room loudspeakers” *Dec 2004*
Seminar at JBL headquarters, Northridge, CA
- “On neutrino oscillations” *Nov 2002*
High energy physics workshop 2002, National Technical University of Athens, Athens, Greece

Honors and Awards

- **EPS Graduate Student Grant** *June 2008*
European Physical Society Particle Accelerator Conference, Genoa, Italy
Awarded to a limited number of graduate students to attend EPAC08. Covers full expenses.
- **Outstanding Academic Achievement Award** *April 2008*
Office of International Services, USC
Awarded to international students for excellent academic performance.
- **Full-time Research Scholarship** *2004 – 2008*
Plasma Accelerator Group, USC
For research work on advanced accelerator projects supported by DoE grants. Covers tuition and living expenses (approx. \$40,000/year).
- **IEEE Student Grant** *June 2007*
IEEE Particle Accelerator Conference, Albuquerque, NM
This grant was awarded to select Ph.D. students in order to present their work at the Particle Accelerator Conference. Covers full expenses.
- **APS Graduate Student Grant** *July 2006 & July 2008*

American Physical Society Advanced Accelerator Concepts Workshop

The grant was awarded to graduate students in order to attend and present their work at the workshop . Covers full expenses. Awarded multiple times.

- **USPAS Sponsored Grant** *Summer 2005*
US Particle Accelerator School, Ithaca, NY
Awarded to graduate students in order to attend the accelerator school. Covers full expenses.
- **Departmental Teaching Assistantship** *2003 – 2006*
Department of Electrical Engineering, USC
Awarded to Ph.D. students for aiding the teaching of undergraduate curriculum classes.
- **Award for Exceptional Performance** *1995 – 1998*
Hellenic Mathematical Society, Greece
Awarded for exceptional performance in the National Mathematical Competition (multiple times).

Selected Other Projects

- **An overview of the evidence for dark matter** *Dec 2007*
I analyzed galaxy rotation curves, gravitational lensing, the virial theorem for galaxy clusters, results from the cosmic microwave background radiation and Big Bang Nucleosynthesis.
- **Cellulosic Ethanol and the future of biofuels: From carbohydrates to hydrocarbons** *Nov 2007*
Investigation of the potential of biofuels as a viable renewable energy source.
- **Development of Beam Propagation numerical code for photonic waveguides** *Dec 2004*
This project required the writing of a beam propagation code in Matlab that simulates the dispersion characteristics and the propagation properties of waves inside different waveguide structures.
- **Analysis and simulations of gravitational lensing effects from black holes** *Nov 2003*
I analyzed weak gravitational lensing theory as a tool for detecting galaxies otherwise non-visible with telescopes. Also, the visual effects of black holes in the detection of galaxies and galaxy clusters were simulated.

Related Coursework (Graduate Level)

Advanced Computer Architecture; Advanced Electromagnetic Theory; Antenna Analysis; Computer Vision; Electromagnetics for semiconductor photonics; Energy and the Environment; Engineering Quantum Mechanics; Image and Video Processing; Lasers; Loudspeaker Design; Microprocessor Laboratory; Nonlinear Optics; Numerical Techniques for Differential Equations; Optical Fibers; Optical Information Processing; Optics; Physics of Dielectric Materials; Plasma Dynamics; Queuing Systems.

Publications

1. "A High Density Hydrogen-Based Capillary Plasma Source for Particle-Beam-Driven Wakefield Accelerator Applications"
Hao Chen, **Efthymios Kallos**, Patric Muggli, Thomas C. Katsouleas and Martin A. Gundersen
IEEE Transactions on Plasma Science (2009), *to appear*
2. "Simulations of a high-transformer-ratio plasma wakefield accelerator using multiple electron bunches"
Efthymios Kallos, Patric Muggli, Tom Katsouleas, Vitaly Yakimenko, Jangho Park and Karl Kusche
Proceedings of the 13th Advanced Accelerator Concepts Workshop, Santa Cruz, CA, (2008), *to appear*
3. "A mask technique for the generation of trains or microbunches with subpicosecond spacing and length "
Patric Muggli, Vitaly Yakimenko, Jangho Park, **Efthymios Kallos**, Karl Kusche and Marcus Babzien
Proceedings of the 13th Advanced Accelerator Concepts Workshop, Santa Cruz, CA, (2008), *to appear*
4. "Some Experimental Results of a Plasma Wakefield Accelerator Using Multiple Electron Bunches"
Efthymios Kallos, Tom Katsouleas, Patric Muggli, Igor Pavlishin, Igor Pogorelsky, Daniil Stolyarov, Vitaly Yakimenko, and Wayne D. Kimura
Proceedings of the 2008 IEEE European Particle Accelerator Conference, Genoa, Italy, pp.1912-1914 (2008)
5. "Generation of Electron Microbunches Trains with Adjustable Sub-picosecond Spacing for PWFA and FEL applications"
Patric Muggli, **Efthymios Kallos**, Vitaly Yakimenko, Marcus Babzien and Karl Kusche
Proceedings of the 2008 IEEE European Particle Accelerator Conference, Genoa, Italy, pp.2830-2832 (2008)
6. "Generation of Trains of Electron Microbunches with Sub-picosecond Spacing"
Patric Muggli, Vitaly Yakimenko, Wayne D. Kimura, Marcus Babzien, **Efthymios Kallos** and Karl Kusche
Phys. Rev. Lett. 101, 054801 (2008)
7. "High-gradient Plasma Wakefield Acceleration with two subpicosecond electron bunches"
Efthymios Kallos, Tom Katsouleas, Wayne D. Kimura, Patric Muggli, Igor Pavlishin, Igor Pogorelsky, Daniil Stolyarov, Vitaly Yakimenko
Phys. Rev. Lett. 100, 074802 (2008)
8. "Plasma Wakefield Acceleration Utilizing Multiple Electron Bunches"
Efthymios Kallos, Tom Katsouleas, Patric Muggli, Igor Pavlishin, Igor Pogorelsky, Daniil Stolyarov, Vitaly Yakimenko, Wayne D. Kimura
Proceedings of the 2007 IEEE Particle Accelerator Conference, Albuquerque, NM, pp.3070-3072 (2007)
9. "Generation and Characterization of the Microbunched Beams with a Mesh Target"
Patric Muggli, **Efthymios Kallos**, Vitaly Yakimenko, Marcus Babzien, Karl Kusche, Wayne D. Kimura
Proceedings of the 2007 IEEE Particle Accelerator Conference, Albuquerque, NM, pp.3073-3075 (2007)
10. "Plasma Wakefield Acceleration Experiments Using Two Subpicosecond Electron Bunches"
Patric Muggli, Wayne D. Kimura, **Efthymios Kallos**, Tom Katsouleas, Karl Kusche, Igor Pavlishin, Igor Pogorelsky, Vitaly Yakimenko

Proceedings of the 2007 IEEE Particle Accelerator Conference, Albuquerque, NM, pp.3079-3081 (2007)

11. "Femtosecond Microbunched Electron Beam - A New Tool for Advanced Accelerator Research"
Igor Pogorelsky, Marcus Babzien, Ilan Ben Zvi, Karl Kusche, Igor Pavlishin, Vitaly Yakimenko, C. Dilley, S. Gottschalk, Wayne D. Kimura, S. Steinhauer, **Efthymios Kallos**, Tom Katsouleas, Patric Muggli, A. Zigler, Sammer Banna, Levi Schächter, David Cline, Feng Zhou, Y. Kamiya, T. Kumita
Proceedings of the Third International Conference on Superstrong Fields in Plasmas, Vol. 827, No. 1., pp. 297-307 (2006)
12. "Generation and Characterization of the Microbunched Beams in the Range from 0.3 to 500 Femtoseconds"
Vitaly Yakimenko, Marcus Babzien, Karl Kusche, **Efthymios Kallos**, Patric Muggli, and Wayne D. Kimura
Proceedings of the 28th International Free Electron Laser Conference, Berlin, Germany, pp.481-484 (2006)
13. "Plasma Simulations and Multibunched Electron Beam Diagnostics"
Efthymios Kallos, Patric Muggli, Tom Katsouleas, Vitaly Yakimenko, Daniil Stolyarov, Igor Pogorelsky, Igor Pavlishin, Karl Kusche, Marcus Babzien, Ilan Ben-Zvi and Wayne D. Kimura
Proceedings of the 12th Advanced Accelerator Concepts Workshop, Lake Geneva, WI, AIP Conference Proceedings No.877, pp.520-526 (2006)
14. "Update on Seeded SM-LWFA and Pseudo-Resonant LWFA Experiments"
W D. Kimura, N. E. Andreev, X. Ding, M. Babzien, I. Ben-Zvi, D. B. Cline, S. M. Hooker, **E. Kallos**, T. C. Katsouleas, K. P. Kusche, S. V. Kuznetsov, P. Muggli, I. V. Pavlishin, I. V. Pogorelsky, A. A. Pogosova, L. C. Steinhauer, D. Stolyarov, A. Ting, V. Yakimenko, A. Zigler, and F. Zhou
Proceedings of the 12th Advanced Accelerator Concepts Workshop, Lake Geneva, WI, AIP Conference Proceedings No.877, pp.534-540 (2006)
15. "Subpicosecond Double Electron Bunch Generation"
Wayne D. Kimura, Vitaly Yakimenko, Marcus Babzien, Xiaoping Ding, **Efthymios Kallos**, Tom Katsouleas, Karl Kusche, Patric Muggli, Igor Pavlishin, Igor Pogorelsky, Daniil Stolyarov, and Feng Zhou
Proceedings of the 12th Advanced Accelerator Concepts Workshop, Lake Geneva, WI, AIP Conference Proceedings No.877, pp.527-533 (2006)
16. "Plasma Density Measurements in Hydrogen-Filled and Plastic Ablation Discharge Capillaries based on Stark Broadening of Atomic Hydrogen Spectral Lines"
Daniil Stolyarov, Igor Pavlishin, Marcus Babzien, Wayne Kimura, Patric Muggli, **Efthymios Kallos** and Vitaly Yakimenko
Proceedings of the 12th Advanced Accelerator Concepts Workshop, Lake Geneva, WI, AIP Conference Proceedings No.877, pp.784-791 (2006)
17. "Plasma-Based Advanced Accelerators at the Brookhaven Accelerator Test Facility"
I. V. Pogorelsky, M. Babzien, K. P. Kusche, I. V. Pavlishin, V. Yakimenko, C. E. Dilley, S. C. Gottschalk, W. D. Kimura, T. Katsouleas, P. Muggli, **E. Kallos**, L. C. Steinhauer, A. Zigler, N. Andreev, D. B. Cline and F. Zhou
Laser Physics, Vol.16, No.2, pp. 259-266 (2006)
18. "A Multibunch Plasma Wakefield Accelerator"

Efthymios Kallos, Tom Katsouleas, Patric Muggli, Ilan-Ben Zvi, Igor Pogorelsky, Vitaly Yakimenko, Igor Pavlishin, Karl Kusche, Marcus Babzien, Feng Zhou and Wayne D. Kimura
Proceedings of the 2005 IEEE Particle Accelerator Conference, Knoxville, TN, pp.3384-3386 (2005)

19. "Plasma Wakefield Accelerators Using Multiple Electron Bunches"
Efthymios Kallos
Ph.D. Thesis, University of Southern California, Los Angeles, CA (2008)
20. "Study of the Smith-Purcell effect in dielectric corrugated waveguides"
Efthymios Kallos
Diploma Thesis, National Technical University of Athens, Athens, Greece (2003)

References

- Prof. Tom Katsouleas
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