

DHRUVA KULKARNI

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EXPERIMENTAL PHYSICIST AND COMPUTER ENGINEER

- As an Experimental Physicist and Computer Engineer, possess a varied skillset ranging from expertise in applied and engineering physics to three years of industrial experience as a software engineer in an innovative startup.
- Am currently seeking an intellectually challenging career opportunity in a Science/Technology related field with a large-scale use case or wide ranging impact.

PROFESSIONAL EXPERIENCE

Graduate Teaching/Research Assistant

2009 – 16

Department of Physics and Astronomy, Clemson University, Clemson, SC, USA

- **Summary:** Ph.D. candidate in experimental/applied physics from the Surface and Interface Nanoscience Lab, using ion beams and an EBIT (Electron Beam Ion Trap) - a unique machine that produces highly charged ions which are usually found only in stellar environments. The temperature of the trapped plasma is comparable to the temperature of the sun's surface, so studying the effects of these ions on terrestrial materials is an exciting and open problem that formed the bulk of my doctoral dissertation.
- **DARPA – Ion promoted Desorption:** Part of my doctoral dissertation was sponsored by a DARPA grant (W911NF-13-1-0042) under the DARPA LoCo project (advanced to phase II) whose aim was low temperature thin film growth. Our part in this project was to promote selected desorption of reactant co-products at surfaces using highly charged ions instead of the usual heating.
- **Device Physics:** Developed a new technique involving specially constructed electrically-sensitive devices to measure below surface damage caused by ion implantation and thus calculated the quadratic charge-state dependence of stopping power. Our results showed that the existing theory was not sufficient to explain the new findings, and we have shown that this is still an open problem.
- **EBIT:** Took the initiative to model and understand the operation of the deceleration system of the EBIT and was handed responsibility of tuning ion beams from the EBIT. Developed necessary instrumentation/software and protocols to quantitatively characterize beams from the EBIT. Projects included were irradiation of polycarbonate targets for thin film adhesion, Cu₃Si for nano-island growth, nano-diamond and diamond-like carbon targets for investigating chemistry of diamond growth.
- **Surface Science:** Performed depth-profiling studies using an Auger Electron Spectrometer for Savannah River National Laboratories (SRNL) on specially treated steel for hydrogen-isotope and nuclear waste storage. Acquired hands on experience and expertise with UHV equipment. Updated legacy molecular dynamics codebase to include new force-field potentials. Responsible for all software driven processes in lab. Created an automation framework for real-time data acquisition and monitoring of lab equipment.
- **Other Projects and Research Interests:** Charge and energy exchange of singly and multiply charged ions, High energy density modification of materials, Ion scattering from surfaces, Novel ion transport methods, Hot electron femto-chemistry at surfaces

Please see publications for details

Software Engineer

2006 – 08

Nevis Networks India Pvt. Ltd., Pune, India

- **LANBlaster:** Developed an industry-first commercial-standard traffic generator that provided High Speed Stateful Traffic (10 Gbps) using a proprietary hyper-threaded multi-core network processor that achieved stateful TCP sessions across 12 ports with configurable parameters like number of clients/servers, transactions per connection, average packet size, custom/random payload, customizable client-to-server acknowledgement ratio, etc.
- **End to end development:** Developed the light weight TCP/IP stack on the network processor data plane, a scriptable user interface on the network processor control plane, and also a remote-operation enabled real-time statistics reporting module.
- **Proficiencies:** C, TCP/IP, embedded systems programming, Python, Bash, Linux, Network programming

Intern Software Engineer

2005 – 06

Nevis Networks India Pvt. Ltd., Pune, India

- Developed statistics collector tool to gather statistics of end-host behaviour with respect to packet-profiling to help tune thresholds for Traffic/Protocol Anomaly Detection modules.
- Crafted other tools using Linux to get over pain points in other stress testing at Nevis Networks, viz., User Authentication, IP Fragmentation Stress Testing

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ACADEMIC QUALIFICATIONS

Ph.D. (Physics, GPA 4.0/4.0)

Clemson University, Clemson, SC, USA

Qualifying Examination – 1st place

Outstanding Graduate Teaching Assistant Award – College of Engineering and Science (2015-16)

Travel Grants – PEGAS (Clemson University) (2014, 2016), SESAPS (2014, 2015)

2017
Expected

M.S. (Physics, GPA 4.0/4.0)

Clemson University, Clemson, SC, USA

Outstanding Graduate Teaching Assistant Award - Physics and Astronomy (2010-11)

Member - Phi Kappa Phi Honor Society (2011-current)

2016

B.E. (Computer Engineering, First Class GPA equiv. 3.5/4.0)

PICT, Pune University, India

Stood 2nd in Concepts '06 - a national level senior projects competition (2006)

2006

PUBLICATIONS AND PRESENTATIONS

Published papers:

1. D.D. Kulkarni, D.A. Field, D.B. Cutshall, J.E. Harriss, W.R. Harrell, C.E. Sosolik, "Probing kinetically excited hot electrons using Schottky diodes", *J. Vac. Sci. Tech.*, (2017) (in press)
2. D.D. Kulkarni, L.A.M. Lyle, C.E. Sosolik, "Ion transport through macrocapillaries - oscillations due to charge patch formation", *Nucl. Instrum. and Meth. B*, **382** 54 (2016)
3. D.D. Kulkarni, R.E. Shyam, D.A. Field, E.S. Srinadhu, J.E. Harriss, W.R. Harrell, C.E. Sosolik "Encapsulating Ion-Solid Interactions in Metal-Oxide-Semiconductor (MOS) Devices", *IEEE Trans. Nucl. Sci.* **62** 3346 (2015)
4. D.D. Kulkarni, R.E. Shyam, D.B. Cutshall, D.A. Field, J.E. Harriss, W.R. Harrell, C.E. Sosolik, "Tracking subsurface ion radiation damage with metal-oxide-semiconductor device encapsulation", *J. Mater. Res.* **30** 1413 (2015)
5. R.E. Shyam, D.D. Kulkarni, D.A. Field, E.S. Srinadhu, D.B. Cutshall, W.R. Harrell, J.E. Harriss, C.E. Sosolik, "First multicharged ion irradiation results from the CUEBIT facility at Clemson University", *AIP Conf. Proc.* **1640** 129 (2015)

Technical Reports:

1. C.E. Sosolik, "Final Report: Multicharged Ion Promoted Desorption (MIPD) of Reaction Co-Products", Report for DARPA LoCo (W911NF-13-1-0042)

Manuscripts in preparation:

1. Space charge effects in extracted ion beams from the CUEBIT (*submitted, under review*)
2. Highly charged ion induced damage on PC targets (*submitted, under review*)
3. Highly charged ion induced defect assisted nanofeature growth on Cu₃Si (*submitted, under review*)
4. Heavier-than-target surface scattering (*in preparation, expected 2017*)
5. CUEBIT – Clemson University Electron Beam Ion Trap (*in preparation, expected 2017*)

Presentations:

1. "Modeling Heavy Atom Scattering" AVS International Symposium and Exhibition 2012
2. "Measuring charge dependent stopping powers at low kinetic energy using MOS devices" – Dynamics, Interactions and Electronic Transitions at Surfaces (DIET) 2014
3. "Measuring Potential Energy Dissipation using MOS devices irradiated with Multiply Charged Ions (MCIs)" – Southeastern Section of the American Physical Society 2014
4. "Heavier-than-target surface scattering" – Southeastern Section of the American Physical Society, 2015
5. "Transporting Ions Flexibly" – Symposium for Introduction to Research in Physics, 2015
6. "Hyperthermal Ion Induced Hot Carrier Excitations in a Metal Probed using Schottky Diodes" - American Vacuum Society – International Symposium and Exhibition 2016

TEACHING

Courses taught: PHYS 1240, PHYS 2090, PHYS 2100, PHYS 2230, PHYS 3250, PHYS 8750 – "Scientific Computing"

Graduate Student Research Mentor: Undergraduates - 4 students, High School – 3 students

OUTREACH AND COMMUNITY INVOLVEMENT

Graduate Student Government Senator: Senator representing Department of Physics and Astronomy

Lab Coordinator: "Laurens STEM 3" - an innovative initiative for scientific development of local high school teachers

Volunteer: Science Fairs/Events at Clemson University, Clemson Elementary School, Laurens High School