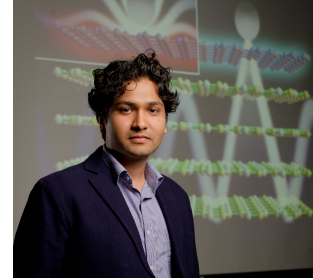


Dr. Anshuman Kumar

CONTACT INFORMATION

Work: +1-217-550-2398
E-mail: akumr@alum.mit.edu
WWW: anshuman.mit.edu
Massachusetts Institute of Technology
Mechanical Engineering Department
77 Mass. Ave., Room 3-435
Cambridge, MA 02139 USA



RESEARCH INTERESTS

Intersection of quantum optics & condensed matter for low dimensional systems: experimental and theoretical aspects of photonics in 2D materials & topological insulators, quantum plasmonics, cavity QED, optical spectroscopy, nanofabrication, scanning probe microscopies

CURRENT ACADEMIC POSITION

Research affiliate, Massachusetts Institute of Technology
Mechanical Engineering Department

EDUCATION

Massachusetts Institute of Technology, Cambridge, MA

Ph.D., Mechanical Engineering Department, Feb 2016

- Thesis Topic: *Engineering light-matter interaction using 2D materials*
- Advisor: Professor Nicholas X. Fang
- Area of Study: Nanophotonics

Indian Institute of Technology Bombay, Mumbai, India

M.Tech. & B.Tech. Dual degree, Engineering Physics, August 2010

- Dual degree final thesis project:
Zinc oxide nanostructures & their application to organic electronics
 - Advisors: Professor M. Aslam & Professor V. Ramgopal Rao
 - Area of Study: Electronics and nanofabrication
- Dual degree mini project:
A comparison of heterostructure FETs based on ZnO/ZnMnO and GaN/AlGaIn
 - Advisor: Professor S. Dhar
 - Area of Study: Computational condensed matter

AWARDS

- Wunsch Foundation Silent Hoist and Crane Award for outstanding Thesis at MIT (2015)
- Warren M. Rohsenow Fellowship for graduate study at MIT (2011-2012)
- Institute Silver medal awarded to the most outstanding student in the Dual Degree batch in Engineering Physics at IIT Bombay (2010)

REFEREED JOURNAL PUBLICATIONS

- [1] Anshuman Kumar, Andrei Nemilentsau, Kin Hung Fung, George Hanson, Nicholas X. Fang, and Tony Low. Chiral plasmon in gapped Dirac systems. *Phys. Rev. B*, 93, 041413(R), 2016.
- [2] Anshuman Kumar, Tony Low, Kin Hung Fung, Phaeton Avouris, and Nicholas X. Fang. Tunable light-matter interaction and the role of hyperbolicity in graphene-hBN system. *Nano Letters*, 15(5):3172-3180, 2015.

- [3] Anshuman Kumar, Kin Hung Fung, M. T. Homer Reid, and Nicholas X. Fang. Photon emission rate engineering using graphene nanodisc cavities. *Opt. Express*, 22(6):6400–6415, Mar 2014.
- [4] Anshuman Kumar, Kin Hung Fung, M. T. Homer Reid, and Nicholas X. Fang. Transformation optics scheme for two-dimensional materials. *Opt. Lett.*, 39(7):2113–2116, Apr 2014.
- [5] Dafei Jin, Anshuman Kumar, Kin Hung Fung, Jun Xu and Nicholas X. Fang. Terahertz plasmonics in ferroelectric-gated graphene. *Appl. Phys. Lett.*, 102(20):201118, Jul 2013.
- [6] N. Boechler, J. K. Eliason, Anshuman Kumar, A. A. Maznev, K. A. Nelson and Nicholas X. Fang. Interaction of a Contact Resonance of Microspheres with Surface Acoustic Waves. *Phys. Rev. Lett.*, 111:036103, Jul 2013.
- [7] Navid Nemati, Anshuman Kumar, Denis Lafarge and Nicholas X. Fang. Nonlocal description of sound propagation through an array of Helmholtz resonators. *Comptes Rendus Mécanique*, 1631-0721, 2015.
- [8] Anshuman Kumar, Ramesh R. Navan, Ajay Kushwaha, M. Aslam and V. Ramgopal Rao. Performance Enhancement of p-type Organic Thin Film Transistors Using Zinc Oxide Nanostructures. *International Journal of Nanoscience*, 10:761-764, 2011.
- [9] Himanshu Tyagi, Ajay Kushwaha, Anshuman Kumar and M. Aslam. pH-dependent Synthesis of Stabilized Gold Nanoparticles Using Ascorbic Acid. *International Journal of Nanoscience*, 10:857-860, 2011.

CONFERENCES & POSTERS

- [10] Anshuman Kumar, Tony Low, Kin Hung Fung, Phaeton Avouris, and Nicholas X. Fang. Tunable light-matter interaction and the role of hyperbolicity in graphene-hBN system. In *APS New England Section Spring Meeting*, vol. 60, number 5, D3.00001. Bulletin of the American Physical Society, 2015.
- [11] Anshuman Kumar, Kin Hung Fung, Jun Xu, and Nicholas X. Fang. Plasmon modes in Graphene nanodisc cavities. In Gordon Research conference, Poster. 2012.
- [12] Anshuman Kumar, Matt Klug, Jin hong Choi, Jin Wang, and Nicholas X. Fang. Blueprint of a defect tolerant waveguide isolator based on unidirectional surface waves. In *Frontiers in Optics 2011/Laser Science XXVII*, page FMG7. Optical Society of America, 2011.
- [13] Anshuman Kumar, Kin Hung Fung, Jun Xu, and Nicholas X. Fang. Plasmonics in Graphene in the Drude Regime. In Phononics conference, Poster. 2011.

ACADEMIC SERVICE

Organizing committee for Scientific and Research opportunities in India (Sci-ROI) Member, 2015.

STUDENT ADVISING

• **Undergraduate research mentor at MIT**

• *Marc Papakyriakou*

Undergraduate student in MECHE, Loyola Marymount University. UROP: Strong coupling between exciton and plasmon- Theory and experiment for demonstrating coherent coupling between excitons in quantum dots and plasmons in metal. 2013 (MIT).

• *Wai Hong Chan*

Undergraduate student in MECHE, MIT. UROP: Optical properties of monolayer graphene- Experiment involved optimizing scotch tape method for making monolayer graphene. Identifying the number of layers optically using contrast spectroscopy. 2011 (MIT).

- *Yi Zhou*
Undergraduate student in Biology, Mary Baldwin College. UROP: Plasmons at the interface of a metal and anisotropic media- Theory and computation to study plasmons at the interface of a metal and an anisotropic material with arbitrary orientation of optical axis. 2011 (MIT).

- **Student mentor at IIT-Bombay**

Student mentor for freshmen and junior undergraduates in the Physics Department at IIT-B.

- *Freshmen mentor*: Mentored a group of 10 first year students at IIT Bombay to ease their transition from school to college life; went the extra mile to hold several interaction sessions with students and their parents. This work involved close coordination with the faculty, academic office and student dorm officials for taking care of problems faced by the students.
- *Department mentor*: Guided about 60 senior students in the Physics Department, coordinated with various class representatives and faculty advisors regarding students' academic and personal issues. 2009-2010 (IITB).

TEACHING
EXPERIENCE

Massachusetts Institute of Technology, Cambridge, MA

Teaching Assistant

September 2012 to December 2012

(sample graded material and student evaluations available upon request)

Teaching assistant for 2.719: Photonic Materials

- The course dealt with the mathematical and physical understanding of various concepts in nanophotonics, including cutting-edge topics in plasmonics and metamaterials.
- Responsible for homework and recitation sessions and supervision of laboratory projects. Students design and implement photonic devices for final projects.
- Graded problem sets and exams and went the extra mile to introduce recent research topics to students in simple language

Indian Institute of Technology Bombay, Mumbai, Maharashtra

Teaching Assistant

July 2009 to November 2009

Teaching assistant for EP 439: Advanced Laboratory Techniques in Nanoscience

- The course involved hands on experience in various experimental techniques in nanofabrication and characterization, including atomic force microscopy, scanning tunneling microscopy, scanning electron microscopy, X-ray diffraction, UV-Visible spectroscopy, nanoparticle synthesis and physical vapor deposition.
- Responsible for instrument training and supervision of laboratory projects.
- Designed and graded problem sets and exams.

PROFESSIONAL
SERVICE

EHS representative

September 2011 to October 2015

Environment, Health and Safety (EHS) representative for the Fang Lab

- Assisted the PI in complying with regulations and MIT practices under MIT's EHS Management System
- Arranged and provided EHS training. Went the extra mile to develop a lab specific safety training course for new students working in the Fang Lab
- Assisted with disseminating EHS information and regular inspections of the lab space

Referee Service

- *Optics Express*
- *Optics Letters*
- *Physical Review journals*
- *Reviews of Modern Physics*

OTHER	<p>Frequent contributor to Quora</p> <ul style="list-style-type: none"> • Contributions to articles on photonics and condensed matter.
HARDWARE AND SOFTWARE SKILLS	<p>Nanophotonic characterization:</p> <ul style="list-style-type: none"> • Scanning microscopies: AFM, SEM, NSOM • Spectroscopies: UV-Visible, FTIR, Raman <p>Nanofabrication:</p> <ul style="list-style-type: none"> • Physical and chemical vapor deposition, chemical synthesis of nanoparticles • Focused ion beam, nanosphere lithography, electron beam lithography <p>Electronics:</p> <ul style="list-style-type: none"> • Organic transistor fabrication and characterization <p>Computer Programming:</p> <ul style="list-style-type: none"> • C, C++, Python, IDL <p>Numerical Analysis:</p> <ul style="list-style-type: none"> • MATLAB, Mathematica <p>Operating Systems:</p> <ul style="list-style-type: none"> • Linux and Microsoft Windows family (upto Windows 7)
EXPERTISE	<p>Mathematics:</p> <ul style="list-style-type: none"> • Applied Mathematics, Real and Complex Analysis <p>Physics:</p> <ul style="list-style-type: none"> • Nanophotonics, Quantum optics, Condensed matter, Computational materials science
REFERENCES AVAILABLE TO CONTACT	<p>Prof. Nicholas X. Fang (e-mail: nicfang@mit.edu; phone: +1-617-253-2247)</p> <ul style="list-style-type: none"> • Associate Professor, Department of Mechanical Engineering, Massachusetts Institute of Technology ◇ 77 Massachusetts Avenue, Room 3-435B, Cambridge MA-02139, USA ★ <i>Prof. Fang is my current thesis supervisor.</i> <p>Prof. Tony S. Low (e-mail: tlow@umn.edu; phone: +1-612-626-7193)</p> <ul style="list-style-type: none"> • Assistant Professor, Department of Electrical & Computer Engineering, University of Minnesota Twin Cities ◇ University of Minnesota, Keller Hall, Minneapolis, MN 55455, USA ★ <i>Prof. Low is collaborator on my graphene work.</i>
MORE INFORMATION	<p>More information and auxiliary documents can be found at http://anshuman.mit.edu.</p>