# Purnendu

https://purnendu.me/ ATLAS Institute, University of Colorado, Boulder purnendu@colorado.edu

## Interests

Human-centered programmable materials, Personal Fabrication, Soft Robotics, Haptics, Graphene and its derivatives

## Education

**PhD (Creative Technology and Design)** 2018-2023 (expected)
ATLAS INSTITUTE, UNIVERSITY OF COLORADO BOULDER

Interdisciplinary research at the intersection of Design, Material Science and Computation.

**Integrated M. Sc. (Physics)** 2013-2018
INDIAN INSTITUTE OF TECHNOLOGY (IIT), ROORKEE

Specialization in Material Science (Condensed Matter Physics) and Nanofabrication. Pursued an interdisciplinary master's thesis in collaboration with Max Planck Institute for Informatics, Germany

**Master's Thesis** 2017-2018
MAX PLANCK INSTITUTE FOR INFORMATICS

Worked on Acoustic Metamaterials at the Human-Computer Interaction Group in Saarland Informatics Campus, Saarbrücken, Germany.

## Experience

**Graduate Research Assistant** 2018- (present)
ATLAS INSTITUTE, UNIVERSITY OF COLORADO BOULDER

Interdisciplinary research with the Laboratory for Emergent Nanomaterials (with Carson Bruns), BEEM Lab (with Gregory Whiting) and THING Lab (with Daniel Leithinger)

**Research Intern** MAY 2017-JULY 2017
BAUHAUS UNIVERSITY, WEIMAR, GERMANY

Advised by Prof. Eva Hornecker, Human-Computer Interaction chair at Bauhaus-Universität Weimar. Worked on shape-changing soft robotic TUIs (Tangible User Interfaces) and ultrasonic sensing.

**Co-founder and President** SEPT. 2016-APR. 2017
DESIGN STUDIO, IIT ROORKEE

Design Studio, IIT Roorkee is a multidisciplinary studio managed by students at Indian Institute of Technology, Roorkee dedicated to design-oriented research and product development with a stronghold in Human-Computer Interaction, Augmented Reality, Product Design, Game development, Animation and Graphics etc. (http://www.designstudioiitr.in/). I co-founded the group and lead it from its inception as the Founding President.

**Co-founder and Tech Lead** Sept. 2015-Oct.2016
LOG 9 MATERIALS

Log 9 Materials is an Indian startup aiming at the commercial applications of lab-scale graphene nanotechnology and manufacturing high-quality nano-materials (primarily graphene). (www.log9materials.com). As Tech Lead my responsibilities were to look after the overall Research and Development, Innovation, Device Design Fabrication. Designed and fabricated a Graphene Quantum Dots (GQD) based LED and graphene-based multi-action water purification system. Designed and developed PPuF - a graphene-ceramic composite based cigarette filter which lowers the carcinogens in cigarette smoke by 50-60 % (www.ppuf.co.in).

**Undergraduate Researcher** May 2015-Nov.2017 (With an interim break for startup)
SATAPATHI LAB, IIT ROORKEE

Worked on a variety of projects in instrumentation, nanofabrication, microfluidics, additive manufacturing, organic electronics and Biomaterials under the supervision of Dr. Soumitra Satapathi, Asst. Professor, Dept. Of Physics, IIT Roorkee. (http://satapathilab.com/)

**Freelance User Interface and User Experience (UI/UX) Designer** Dec. 2013-May.2015
ROORKEE

Managed a wide variety of cross-media projects involving branding, illustrations, animations, products, UI-UX design, and development for startups (Inst-E-Shop, AAYUU.com, to name a few) as well as industry leaders.

## Publications

**Electriflow: Augmenting Books With Tangible Animation Using Soft Electrohydraulic Actuators**
Purnendu, Sasha Novack, Eric Acome, Mirela Alistar, Christoph Keplinger, Mark D. Gross, Carson Bruns, and Daniel Leithinger. In Special Interest Group on Computer Graphics and Interactive Techniques Conference Labs (SIGGRAPH '21 Labs), August 09-13, 2021. ACM, New York, NY, USA, 5 pages. https://doi.org/10.1145/3450616.3464523

**Electriflow: Soft Electrohydraulic Building Blocks for Prototyping Shape-changing Interfaces**
Purnendu, Sasha Novack, Eric Acome, Christoph Keplinger, Mirela Alistar, Mark D. Gross, Carson Bruns, and Daniel Leithinger. In Designing Interactive Systems Conference 2021 (DIS '21), June 28-July 2, 2021, Virtual Event, USA. ACM, New York, NY, USA, 10 pages. https: //doi.org/10.1145/3461778.3462093

**Soft Electrohydraulic Actuators for Origami Inspired Shape-Changing Interfaces.**
Purnendu, Eric Acome, Christoph Keplinger, Mark D. Gross, Carson Bruns, and Daniel Leithinger. In CHI Conference on Human Factors in Computing Systems Extended Abstracts (CHI '21 Extended Abstracts), May 8–13, 2021, Yokohama, Japan. ACM, New York, NY, USA

**Graphene-Based 3D Xerogel as Adsorbent for Removal of Heavy Metal Ions from Industrial Wastewater**
Purnendu, Soumitra Satapathi, 5, 2, 96-102,2017, Journal of Renewable Materials.

## Patents

**[2020] Method and apparatus for multi-material variable resolution Palmtop 3D printing**
Purnendu, Carson Bruns, Mark D Gross [Provisional Patent Application No 63/061,653 (pending)]

**[2017] A graphene based tobacco smoke filter and a method for synthesizing graphene composition**
Akshay V. Singhal, Purnendu [WO 2017187453 A1]

**[2016] Device and method for real-time thickness controlled spin-coating**
Nipun Sawhney, Purnendu, Soumitra Satapathi [E-106/43/2016/DEL/201611039173 - (pending)]

## Posters

**Graphene-Chitosan Xerogel for Heavy Metal Ion Removal**
Purnendu, Soumitra Satapathi, International Conference On Nanoscience and Technology (ICONSAT), 2016, IISER PUNE

## Selected Press

**TechExplore**
Origami comes to life with new shape-changing materials

**Hackster.io**
New Shape-Changing Materials Come to Life Using Artificial Muscles

**The Institution of Engineering and Technology (IET)**
Paper-thin origami-like artworks wriggle, flutter and bend

**Science Daily**
Origami comes to life with new shape-changing materials

**Archinect**
Electriflow taps advancements in soft robotics to create mechanisms that operate without traditional machine parts

**The Times of India**
IIT-R researcher develops cigarette filter that eliminates most chemicals from smoke, gets 15L funding from institute

## Graduate Coursework

**CU Boulder:**
Haptic Interfaces, Design and Ananlysis of Algorithms, Natural Language Processing, Applied Machine Learning, Theory of Computation, Metamaterial Design Principles, Partial Differential Equations, Bio-inspired Multi-Agent Systems, Quantum Information and Computing

**IIT Roorkee:**
Advanced Condensed Matter Physics, Physics of Nanosystems, Physics and Technology of Thin Films, Advanced Characterization Techniques, Molecular Spectroscopy and Lasers

## Awards

**INSPIRE Scholarship for Higher Education (SHE)**

Department of Science and Technology (DST), Govt. of India (2013-18).

## Invitations and Talks

**Manipulating Shape of Things to come: Folding and Self Assembly**
ATLAS Seminar, University of Colorado Boulder, 14 April 2020.

**The mathematical secrets of Computational Origami**
Statistics, Optimization and Machine Learning Seminar, University of Colorado Boulder, 15 Oct. 2019.

**Future of Graphene in manufacturing**
Short-term program on Make-In-India-Issues and Challenges, NITTTR Chandigarh, 10 Nov. 2017

**Special Invitee at Make-In-India Week, Mumbai, 13-18 Feb. 2016.**

## Services

**Reviewer**
CHI 2019, 2020, 2021; DIS 2021

## Mentoring

**Teis Hart**
Undergraduate student (Senior/4th Year) in Mechanical Engineering, University of Colorado Boulder; Project: Designing a miniature 3D Printer

**Maya Ledvina**
Creative Industries Master's Student in Creative Technology and Design, University of Colorado Boulder

**Aniket Agarwal**
Creative Industries Master's Student in Creative Technology and Design, University of Colorado Boulder

**Marian Baldonado**
Social Impact Master's student in Creative Technology and Design, University of Colorado Boulder

**Cassidy Jensen**
Undergraduate student in Creative Technology and Design, University of Colorado Boulder; Project: Acoustic Metamaterials

**Vishal Shenoy**
Master's student in Mechanical Engineering, University of Colorado Boulder

## Skills

**ADVANCE SKILLS in Design thinking, Design software in both 2D and 3D**
(Adobe Creative Suite, Autodesk Softwares, Rhino with Grasshopper, Cinema-4D, Blender).

**ADVANCE SKILLS in Nano-material fabrication and experimentation**
Including microfluidic control and study, soft-lithography, photolithography, thin film deposition, nanofabrication, chemical fabrication, wet-lab techniques, different types of spectroscopy (Fluorescence, UV-Visible, FTIR), X-Ray Diffraction, Atomic Force Microscopy and Electron Microscopy (SEM,TEM, STM) and instrumentation.

**ADVANCE SKILLS in macro-scale instrumentation, prototyping, and digital fabrication**
3D printing, cutting, molding, casting; instrumentation of most digital machines to handle plastic/composite/metal/wood.

**MEDIUM SKILLS in software development and scientific computing**
Graphics, Animation, Interface and Machine Learning in Python, MATLAB, Javascript, FORTRAN.

**MEDIUM SKILLS in electronic hardware design and assembly**
Digital and analog circuit design, signal processing, microprocessors, fast-prototyping as well as machine building

Fluent in spoken and written English, Hindi, and Maithili-eastern Indian-subcontinent language (mother tongue)

## References

**Carson Bruns**
Assistant Professor, Department of Mechanical Engineering and ATLAS Institute, University of Colorado Boulder; E-Mail: carson.bruns@colorado.edu; Homepage: https://www.colorado.edu/ atlas/carson-bruns

**Mark D Gross**
Director, ATLAS Institute Professor, Department of Computer Science and ATLAS Institute, University of Colorado Boulder; E-Mail: mdgross@colorado.edu; Homepage: http://mdgross.net/

**Gregory Whiting**
Associate Professor, Department of Mechanical Engineering, University of Colorado Boulder; E-Mail: gregory.whiting@colorado.edu; Homepage: https://www.colorado.edu/lab/whiting/gregory-whiting