Shubham Kumar

Roll No.:201801006
BSMS- Physics
Indian Institute of Science Education and Research Tirupati

+91-7892511161
shubham.kumar@students.iisertirupati.ac.in
shubham.kumar@rrimail.rri.res.in
linkedin.com/in/shubham-kumar-56a0501b6

Education

•Indian Institute of Science Education and Research (IISER), Tirupati *Tirupati, Andhra Pradesh*
BS-MS in Physics Aug. 2018 – Aug 2023

Projects and Experiences

•Microfluidics and Single Molecule Biophysics Experiment *April 2023 - may-2024*
Dr. Gautam Vivek Soni, Associate Professor, Soft-Condensed Matter Department, Raman Research Institute

– My primary focus is making cost-effective microfluidic channels utilizing parafilm. These channels are instrumental in immobilizing DNA on surfaces by applying Biotin-streptavidin chemistry and surface chemistry. The overarching goal was to investigate the mechanical properties of DNA in various solutions and explore the impact of proteins on DNA structure. To achieve this, I've employed Fluorescence Microscopy for detailed analysis, surface chemistry methods and wet lab techniques.

– Additionally, in spare time I've conducted experiments involving the generation of droplets using commercially available microfluidic chips and studied the effects of flow rate ration on droplet generation frequency, size and stability.

•Experiments and simulations of transport phenomena in paper-based microfluidic system *JUN 2022- APRIL 2023*
Dr. Pranab Kumar Mondal, Associate Professor, Dept of Mechanical Engineering, IIT Guwahati

– As part of my Master's thesis research, I led the synthesis and characterization of both positive and negative gold nanoparticles. Employing various analytical techniques, including UV-visible, FTIR, FESEM, and TEM analyses, I synthesized the nanoparticles and conducted experiments to conjugate them with antibodies and study its reaction with antigens. These efforts resulted in a comprehensive understanding of the nanoparticles' properties, which was instrumental in our conference paper publication.
– In addition, I led experiments focused on investigating fluid dynamics within paper-based microfluidic porous media. These experiments played a pivotal role in deepening our understanding of lateral flow assay devices. Utilizing water and coloured dye solutions for fluid flow in porous media, I conducted hands-on explorations to observe and analyze flow behaviours. Also, I performed a COMSOL simulation of fluid flow.

•Spreading of liquid drop on rough surfaces *DEC 21 - APRIL 22*
Dr. Dileep Mampallil, Associate Professor, Department of Physics, IISER Tirupati

– During this semester project, I conducted an in-depth investigation into the dynamics of liquid drops on various rough surfaces. I systematically analyzed the temporal evolution of drop radius upon contact using sandpaper with different degrees of roughness. Employing MATLAB code, I comprehensively examined the spreading process, gaining valuable insights into the underlying dynamics.

Technical Skills

- **Programming Languages**: Python, C++, Matlab, LabVIEW (Basic)
- **Design/Analysis Software**: ImageJ FreeCAD
- **Operating System**: Windows, Linux
- **Instruments and Techniques**: Fluorescence Microscopy, DLS, FTIR, Soft lithography.

Publications

•Prateechee Padma Behera, **Shubham Kumar**, Monika Kumari, Dr. Pranab Kumar Mondal and Dr. Ravi Kumar Arun. "Gold Nanoparticle-Antibody Bio-probe Analysis: Synthesis, Conjugation, Characterization and Dot Blot Assay on Paper", 9^{th} International and 49^{th} National Conference of Fluid Mechnanics and Fluid Physics (FMFP), December 14^{th}-16^{th} 2022, IIT Roorkee, India.

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Paper under review

–*Sumit kumar Mehta*†, ***Shubham Kumar***†, Amy Q. Shen, Dr. Pranab Kumar Mondal. "Paper-Based Microfluidics: Analyte-Driven Imbibition Under the Lens"
†authors having equal Contribution.