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Droplets under Extreme Conditions: A shocking story

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Abstract

I will first present a portable setup to generate shock waves using the exploding wire technique. Subsequently, I will showcase how droplets of various kinds (liquid metal, water, and polymeric liquids) interact and breakup in the shock wave and associated flow. I will also show the various instabilities that develop prior to breakup that are universal in nature. Lastly, I will showcase some results on shock-droplet flame interactions with analyses on flame extinction and droplet breakup.

Biographical Sketch

Prof. Saptarshi Basu received his PhD in Mechanical Engineering from University of Connecticut in 2007 with Prof. B. M Cetegen before joining University of Central Florida as an Assistant Professor. In 2010, he relocated to India and joined the prestigious Indian Institute of Science in Bangalore where he is currently the Pratt and Whitney Chair Professor in the Department of Mechanical Engineering.

Prof. Basu primarily works on multiphase systems, especially droplets at multiple length and timescales across multiple application domains ranging from surface patterning to combustion. Recently Prof. Basu have done extensive research on transmission of aerosols during COVID and on the efficacy of facemasks. His research marries fundamental aspects of classical fluid mechanics like vortex dynamics and swirling flows and the more interdisciplinary aspects of interfacial transport as in droplets to offer unprecedented insights into multiphase systems.

He is a fellow of Indian National Academy of Engineering, ASME, Institute of Physics, Royal Aeronautical Society and Royal Society of Chemistry. Prof. Basu is the recipient of DST Swarnajayanti Fellowship (equivalent of PECASE) in Engineering. Prof. Basu is a co-founder of a Biotech startup specializing in AI based Point of Care Diagnostics and a technical advisor to a deep tech startup involved in micro gas turbines. Prof. Basu serves as an editor/guest editor of several journals like Nature-scientific reports, Experiments in Fluids and European Physical Journal Special Topics. Prof. Basu's research is extensively funded by Department of Defence, Indian Space Research Organization, Department of Science and Technology, Indo-German Science and Technology Center, Indo-US Clean Energy Center, NSF and industries like Siemens and Tata Motors. Prof. Basu has guided more than 20 PhD students in his career and published over 200 journal articles including many in Journal of Fluid Mechanics, Physics of Fluids, Combustion & Flame, Langmuir, Proc. Roy. Soc. etc.

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