

## Scientific Keynote

# Microfluidics cavitation and jetting: an ultrafast inertial tool for bioengineering and medicine at the mesoscale

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Microfluidic cavitation and jetting enable ultrafast, highly focused liquid microjets that can interact with soft matter at the mesoscale in ways unattainable with conventional tools. In this keynote, I will discuss how confined cavitation in microfluidic systems can be precisely tuned to control jet formation, dynamics, and penetration into soft substrates, including skin, thereby creating an inertial platform for minimally invasive bioengineering and medical applications. I will highlight how these phenomena bridge fundamental fluid dynamics with practical technologies for needle-free drug delivery and advanced mesoscale processing in medicine and biotechnology.



**Prof. Dr. David Fernandez Rivas'** research interests and expertise are in the areas of microfluidics, solar-to-fuel cells, process intensification, acoustic cavitation, sonochemistry and transdermal drug delivery alternatives. In 2019, David obtained the European Research Council Starting Grant for his project BuBble Gun, aimed at penetrating microjets in soft substrates. David wrote the book *Empathic Entrepreneurial Engineering*, and he is inventor of a patent commercialized by the spin-off BuBclean (2013) of which he is cofounder. He also founded FlowBeams, a spin-off from the University of Twente (2021) to valorize his needle-free injection research and subsequent patents on microfluidic systems. In 2024, his FlowBeams team received the Transition grant from the European Innovation Council EIC and was honoree of the Consumer Electronic Show Las Vegas in Beauty and Cosmetics. Selected prizes: Young

Sonochemist Award: Japan Society of Sonochemistry (JSS, 2011). Pieter Langerhuizen Lambertuszoom Fonds prize (2016) awarded by the Royal Holland Society of Sciences and Humanities (KHMW). Engineer of the Year 2021, and the Prince Friso Award by the Royal Dutch Institute of Engineers (KIVI). BSc.: 2004; MSc.: 2006 Nuclear Engineering, InSTEC, Havana, Cuba; PhD at the University of Twente UT (2012) and Professor (2021) in the Mesoscale Chemical Systems Group, UT. He is research affiliate at the Mechanical Engineering Department, Massachusetts Institute of Technology, USA (2017) and Visiting Professor at the Dermatology Department, Erasmus MC Hospital, Rotterdam, The Netherlands. More on <https://www.linkedin.com/in/david-fernandez-rivas-5395a48/> | [www.david-fernandez-rivas.com](http://www.david-fernandez-rivas.com)