



# International Conference on Micro Nano Fluidics (ICOM 2025)



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**Speaker/affiliation:** Prof. Anirudh Singh Rana, BITS Pilani, India

**Tentative topic of the invited talk**

*Non-equilibrium Gas Dynamics: Interplay of Fluid Dynamics and Thermodynamics in Non-equilibrium Flows*

**Abstract of the invited talk**

Non-equilibrium gas dynamics provides a powerful framework for understanding flows where classical Navier–Stokes–Fourier descriptions fail. Such situations arise in microscale and rarefied flows, hypersonic aerothermodynamics, and multiphase or multi-temperature systems, where deviations from local thermodynamic equilibrium strongly influence transport and dissipation. In this talk, I will highlight how the interaction of fluid dynamics and thermodynamics shapes non-equilibrium flow behavior, with emphasis on the role of additional internal variables, extended constitutive relations, and moment models. Illustrative examples will include shock structures, micro/nanofluidic flows, and thermodynamic corrections near interfaces. The aim is to convey how bridging the principles of continuum mechanics with nonequilibrium thermodynamics leads to physically consistent models capable of capturing phenomena beyond the classical framework.