

# “Phononic Frequency Combs”

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## Abstract

Phononic frequency combs (PFC) are the mechanical analogs of celebrated photonic frequency combs. These represent a newly documented physical phenomenon in the well researched physical domain of mechanical resonators [1]. The emergence of PFC is mediated by nonlinear modal coupling. Through a series of experiments using micromechanical resonators, various physical features of phononic frequency combs have been identified. These include drive parameters for comb operation, hysteresis for comb spectrum tailoring and nonlinear sensitivity to physical perturbations. My talk will describe the physics of phononic frequency combs and will emphasize how these combs could be foundational to the fields of materials science, molecular science and chemical science. In that respect, I will present our first conceptual demonstrations of material combs, molecular combs and chemical combs respectively. I will also showcase our recent demonstration of broadband phononic combs using optical tweezers [2]. The future work will be focused on the applications of phononic frequency combs in sensing, communications and quantum information science.

[1] Ganesan, A., Do, C. and Seshia, A., 2017. Phononic frequency comb via intrinsic three-wave mixing. *Physical review letters*, 118(3), p.033903.  
[2] de Jong, M.H., Ganesan, A., Cupertino, A., Gröblacher, S. and Norte, R.A., 2023. Mechanical overtone frequency combs. *Nature Communications*, 14(1), p.1458.

## Speaker Bio

Adarsh Ganesan is currently an assistant professor at Ahmedabad University, India. He holds his Ph.D. in Engineering from Cambridge University and BE (Hons) in Electrical and Electronics Engineering from Birla Institute of Technology and Science (BITS), Pilani. He completed his postdoctoral research at the National Institute of Standards and Technology, Gaithersburg. Adarsh has been recognized for his doctoral work on phononic frequency combs by the 2017 John Winbolt Prize (Cambridge University), 2017 UK Doctoral Researcher Award, 2018 APS GSNP Student Speaker Award, 2018 IET Hudswell International Research Scholarship and 2019 BITS Alumni Association Global 30 Under 30 Award.



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