**Floquet synthetic dimensions for analog Hamiltonian simulation of topological physics**

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Dynamically modulated photonic resonators offer tantalizing possibilities for building analog simulators of Hamiltonians both in the quantum and classical realm. Particularly, synthetic frequency dimensions formed through modulation at the resonator’s free-spectral range have been used to demonstrate a wide variety of topologically nontrivial phenomena, both in Hermitian and non-Hermitian systems. In this talk, I will introduce another synthetic dimension platform using modulation at frequencies far below the FSR of the resonators, making it more amenable to on-chip implementations. This platform, which we term Floquet synthetic dimensions, allows for direct reciprocal-space (k-space) engineering of lattice Hamiltonians in high dimensions through modulation at multiple irrationally related frequencies applied to a photonic molecule. Quantized transport – the hallmark of topology – not only survives multiple RF and optical drives, but is abetted by finite dissipation in this Floquet dimension platform. Our preliminary experiments provide support for the contrast between topological and trivial regimes. Furthermore, we provide a path to realizing Weyl points and measuring the Berry curvature emanating from these k-space magnetic monopoles, illustrating the capabilities for higher-dimensional topological Hamiltonian simulation in this platform.

**Short Bio:**

**Avik Dutt** is an Assistant Professor and a National Quantum Lab (QLab) Fellow at the University of Maryland, College Park, with a joint appointment between the Department of Mechanical Engineering and the multidisciplinary Institute for Physical Science and Technology (IPST). He obtained the M.S./Ph.D. degrees in Electrical and Computer Engineering from Cornell University in 2017, and a Bachelor’s degree from Indian Institute of Technology, Kharagpur in 2011. His doctoral dissertation about on-chip quantum and nonlinear optics was partially supported by a Jacobs Fellowship and received the Zurich Instruments thesis award in 2017. Subsequently he acquired postdoctoral training on quantum Hall effects and topology at Stanford. Dutt has a broad background in quantum and nonlinear nanophotonics and topological photonics. He has also proposed theoretical schemes for analog and digital quantum simulation. He was selected as a 2020 Rising Star of Light, and was the editor's pick for Outstanding Reviewer by the journal Light: Science & Applications in July 2020. He has more than 100 journal articles and peer-reviewed conference publications, and presented more than 25 invited talks. Several of his primary authored papers have been published in reputed journals including Science, Nature Physics, Science Advances and Nature Communications, making him among the top 2% of most yearly cited scientists in optics since 2021.