



INDIAN INSTITUTE OF TECHNOLOGY MANDI
भारतीय प्रौद्योगिकी संस्थान मंडी

Institute Colloquium

**Dreaming of mode-specific chemistry –
inside a “box”?**



Prof. K. Srihari
Professor, Department of
Chemistry, Indian Institute of
Technology Kanpur



14th Februry, 2025



05:00 PM



Auditorium,
North Campus

Abstract:

From time immemorial chemists have been fascinated by the prospect of performing mode-specific chemistry. In other words, exciting specific vibrational, rotational, or translational modes of reacting molecules to either accelerate or inhibit the reaction rate. However, achieving this “holy grail” has proven to be more elusive than perhaps was initially appreciated. Turns out that one of the main “villain” that is preventing us from succeeding is the phenomenon of intramolecular vibrational energy redistribution (IVR) within the excited reactant molecules. Consequently, for nearly half a century physical chemists have devised ingenious experiments and come up with novel theoretical models for gaining a precise understanding of the IVR phenomenon. En route, researchers have discovered interesting connections between the energy flow dynamics in molecules and, apparently unrelated, phenomenon in different fields like condensed matter physics and dynamical astronomy. More recently, intriguing connections between cavity quantum electrodynamics and mode-specific chemistry have emerged wherein vacuum fluctuations in an optical cavity seems to influence the reaction rates. Does this mean that we have managed to get around the IVR bottleneck? This talk provides a broad overview of the fascinating connections, outstanding challenges, and our modest attempts to keep the dream alive.

Brief bio:

Srihari Keshavamurthy is a professor of chemistry at the Indian Institute of Technology (IIT) Kanpur. He did his BSc from Vivekananda College Chennai, MS from Villanova University USA, and obtained his PhD in chemical physics from the University of California Berkeley USA under the guidance of William H. Miller. After post-doctoral research with Gregory S. Ezra at Cornell University USA he joined IIT Kanpur in 1996. His research interests are in the field of chemical reaction dynamics with an emphasis on the mechanisms of intramolecular vibrational energy flow, quantum control, and dynamical tunneling. Srihari received the Gopal Das Bhandari memorial outstanding teacher award at IIT Kanpur in 2008, the Chemical Research Society of India (CRSI) Bronze Medal in 2016, and the Indian National Science Academy (INSA) Teachers award in 2017. In 2023 he was at IISc Bengaluru as the Satish Dhawan Visiting Chair Professor in the IPC department.