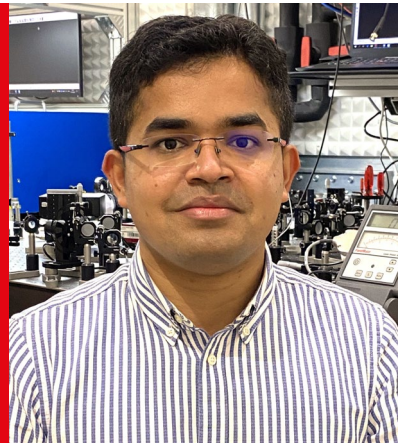


# Imaging Electronic and Atomic Motion in Molecules



**Prof. Manish Garg**  
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Stuttgart

APER0  
after the  
colloquium

Monday  
March 25th  
16:15  
Room CE1 2

or on zoom :

<https://epfl.zoom.us/j/64905394203>

The capability to capture electronic and atomic motions at their natural length (Ångstrom-scale) and time-scales (attoseconds to femto-seconds) is a long-standing goal in modern science. In my talk, I will show you how electron dynamics in molecules can be locally probed with angstrom-scale spatial resolution and 300 attosecond temporal resolution simultaneously, at the single orbital-level with the help of a scanning tunnelling microscope (STM), defying the previously established fundamental space-time limits [1-4]. Atomic motions in a single molecule can be directly imaged by realizing coherent anti-Stokes Raman spectroscopy in an STM. These recent developments pave the way towards direct real space-time imaging of chemical reactions and phase transformations in two-dimensional materials.

1. Garg *et al.* *Nature* 359-363, **538** (2016).
2. Gutzler, Garg *et al.* *Nature Reviews Physics* **3**, 441-453 (2021).
3. Garg *et al.*, *Nature Photonics*, **16**, 196-202 (2022).
4. Garg and Kern. *Science* **367** (6476), 411-415 (2020).