

**Prize Talk**

PRV III Tue 13:00 HSZ/0004

**Optics of single molecules explored with sub-nm precision —**

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Light-matter interaction is essential for mechanisms such as luminescence, photosynthesis, and energy harvesting, defining the emission characteristics of molecular systems and governing the conversion of energy between photons and electrons. While these processes are intensively studied and employed, little is known about their dependence on atomic-scale properties since reaching such precision in optics is extremely demanding. This challenge is nowadays overcome thanks to the combination of optical spectroscopy approaches with scanning

probe microscopy, which profit from the extreme field enhancement provided by the tip that enables atomic-scale optics [1]. In my talk, I will discuss how this approach can be applied to gate fluorescence by individual charges [2], used to induce photochemical reactions with sub-nm precision [3], and enables probing optical properties of individual biological pigments.

[1] A. Rosławska, T. Neuman, B. Doppagne, A. Borisov, M. Romeo, F. Scheurer, J. Aizpurua, G. Schull, Phys. Rev. X, 12, 011012, 2022.

[2] K. Kaiser, S. Jiang, M. Romeo, F. Scheurer, G. Schull, A. Rosławska, Phys. Rev. Lett. 133, 156902, 2024.

[3] A. Rosławska, K. Kaiser, M. Romeo, E. Devaux, F. Scheurer, S. Berciaud, T. Neuman, G. Schull, Nat. Nanotechnol., 19, 738-743, 2024.