

## Nanoscale Physical Chemistry Studied by SPM – Single-Molecule Tautomerization and Near-Field Chemistry/Physics

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Scanning probe microscopy provides a unique opportunity to study surface chemistry at the nanoscale, e.g., chemical reactions of individual adsorbates [1,2]. In the first part of my talk, I will discuss single-molecule tautomerization of porphycene on metal surfaces, which are induced by various external stimuli, namely heat, electron, light, and chemical interaction [3-6].

Combination of SPM with optical excitation allows us to investigate light-matter coupling at the nanoscale [7] and applicable to ultrasensitive microspectroscopy such as tip-enhanced Raman spectroscopy (TERS) [8]. In the second part, I will discuss near-field induced physics and chemistry and present plasmon-mediated chemical reactions [9], plasmon-assisted resonant electron transfer [10], and nanoscale vibrational spectroscopy using TERS.

### References

- [1] W. Ho, *J. Chem. Phys.* 117, 11033 (2002). [2] Y. Kim et al. *Prog. Surf. Sci.* 90, 85 (2015). [3] *Phys. Rev. Lett.* 111, 246101 (2013). [4] *ACS Nano* 9, 7287 (2015). [5] *Nano Lett.* 16, 1034 (2016). [6] *Nature Chemistry*, 8, 935 (2016). [7] K. Kuhnke et al. *Chem. Rev.* 117, 5174 (2017). [8] B. Pettinger et al. *Annu. Rev. Phys. Chem.* 63, 379 (2012). [9] *Nano Lett.* 18, 152 (2018). [10] *Phys. Rev. Lett.* 121, 226802 (2018).