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# IAP-SEMINAR

## EINLADUNG

Termin: **Montag, 22.11.2010 um 16:00 Uhr**  
Ort: **Technische Universität Wien,  
Institut für Angewandte Physik,  
Seminarraum 134, Turm B (gelbe Leitfarbe), 5. OG  
1040 Wien, Wiedner Hauptstraße 8-10**

Vortragender: **Prof. Maki Kawai**  
Dept. of Advanced Materials Science, University of Tokyo/Japan

Thema: **Single molecule spectroscopy and reaction**

### Kurzfassung

Ultimate spatial resolution of scanning tunneling microscope (STM) enables us to observe the inner electronic, vibrational [1-5] and spin [6] structures of a molecule adsorbed on solid surfaces. Vibrational spectrum of a single molecule provides useful information not only for the chemical identification of the molecule [1] but also for investigating how molecular vibrations can couple with the relevant dynamical processes [2, 3]. The response of vibrationally mediated molecular motion to applied bias voltage, namely an “action spectrum”, can reveal vibrational modes that excited through STM inelastic tunneling processes, because the molecular motion is induced only *via* the inelastic tunneling processes [4]. Thus, the action spectrum would be a candidate for detecting which vibrational mode is actually excited and associated with molecular motions. The mechanism to excite vibrational modes of molecules is revealed to be a resonant mechanism [5]. A theoretical analysis of the action spectrum even enabled us to learn about the assorted excitation relevant for the reaction to occur [7]. Life-time of the vibrational excited state was found to lengthen by inserting insulator thin film of MgO, decoupling the adsorbate and metal, enabled to split water molecule by exciting the OH stretching mode [8].

[1] Y. Kim, T. Komeda, and M. Kawai, *Phys. Rev. Lett.* **89** (2002) 126104. S. Katano, M. Trenary, Y. Kim and M. Kawai, *Science* **316** (2007) 1883.

[2] T. Komeda, Y. Kim, M. Kawai, et al., *Science* **295** (2002) 2055.

[3] T. Okada, Y. Kim and M. Kawai, submitted for publication (2010).

[4] Y. Sainoo, Y. Kim, T. Okawa, et al., *Phys. Rev. Lett.* **95** (2005) 246102.

[5] M. Ohara, Y. Kim and M. Kawai, *Phys. Rev. Lett.* **100** (2008) 136104.

[6] N. Tsukahara, K. Noto, M. Ohara, S. Shiraki, N. Takagi, Y. Takata, J. Miyawaki, M. Taguchi, A. Chainani, S. Shin and M. Kawai, *Phys. Rev. Lett.* **102** (2009) 167203.

[7] K. Motobayashi, Y. Kim, H. Ueba and M. Kawai, *Phys. Rev. Lett.* **105** (2010) 07 6101.

[8] H.-J. Shin, J. Jung, K. Motobayashi, S. Yanagisawa, Y. Morikawa, Y. Kim and M. Kawai, *Nature Materials* **9** (2010) 442-447.

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*Alle interessierten Kolleginnen und Kollegen sind zu diesem Seminar  
(45 min mit anschließender gemeinsamer Diskussion) herzlich eingeladen.*

*U. Diebold e.h.  
(Seminar-Chairperson)*

*H. Störi e.h.  
(LVA-Leiter)*