

# FUKUTANI LAB.

## Controlling Electrons, Spins, and Protons at Surfaces



Department of Fundamental Engineering

Surface and interface science  
Department of Applied Physics, Graduate School of Engineering

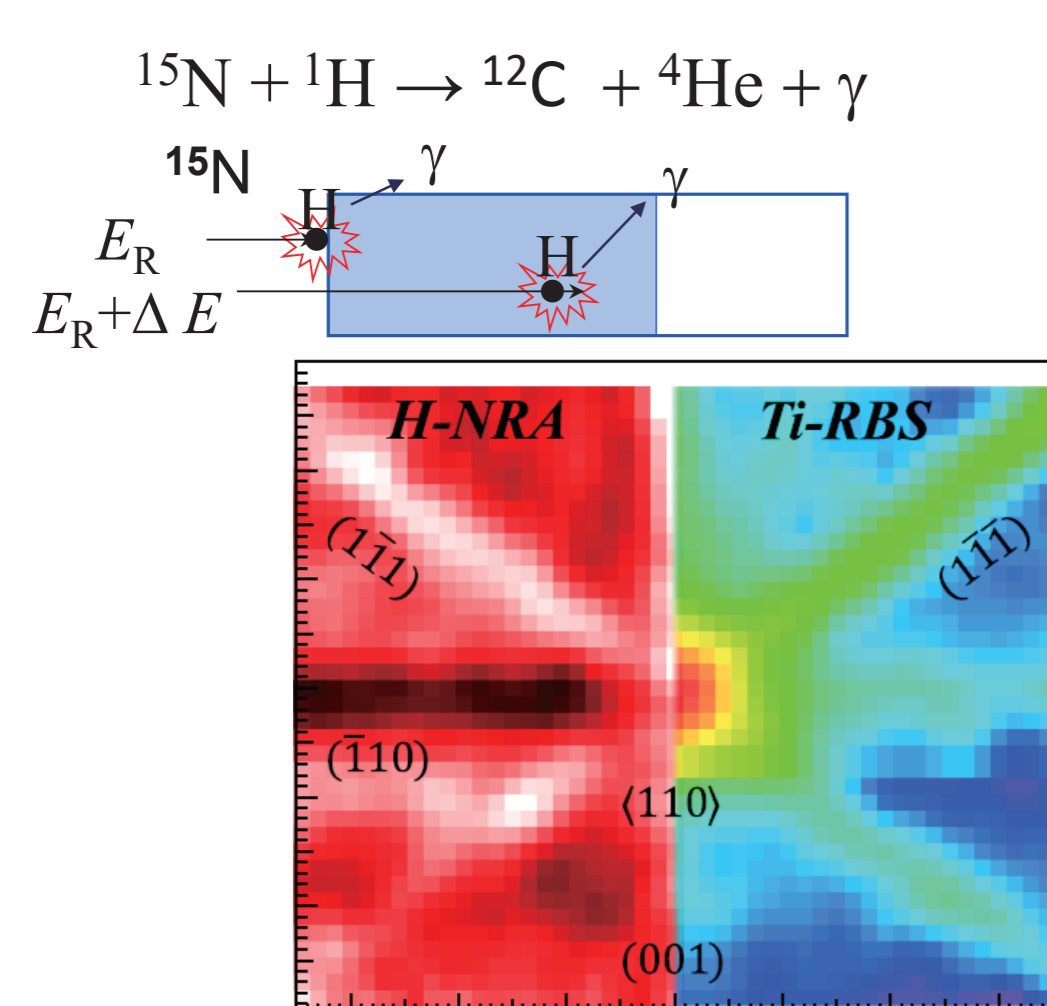
<http://www.oflab.iis.u-tokyo.ac.jp>

### Overview

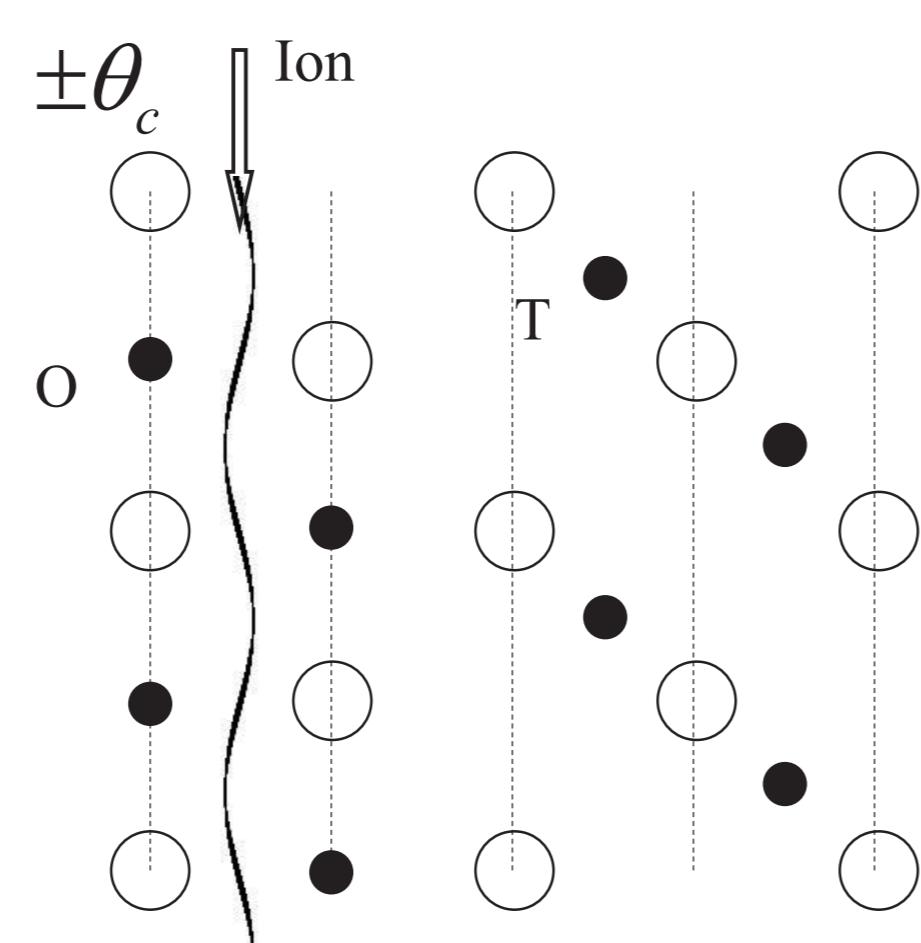
Surfaces and interfaces have different electronic states from those of bulk materials, because they have lower dimension and symmetry compared to the bulk. Thus, surfaces and interfaces are expected to reveal peculiar properties, such as interface electric conductivity and catalytic activities. From a technological point of view, surfaces play crucial roles in the formation, storage, and sensing of hydrogen that is a clean energy medium. In our laboratory, we develop novel experimental techniques to precisely observe hydrogen in aimed at elucidating the mechanisms of proton transport, electron dynamics, spin conversion and non-equilibrium hydrogenation of nm-thick metal/oxide films, which leads to synthesis of novel functional surfaces.

### Experimental Techniques

#### [Nuclear Reaction Analysis]

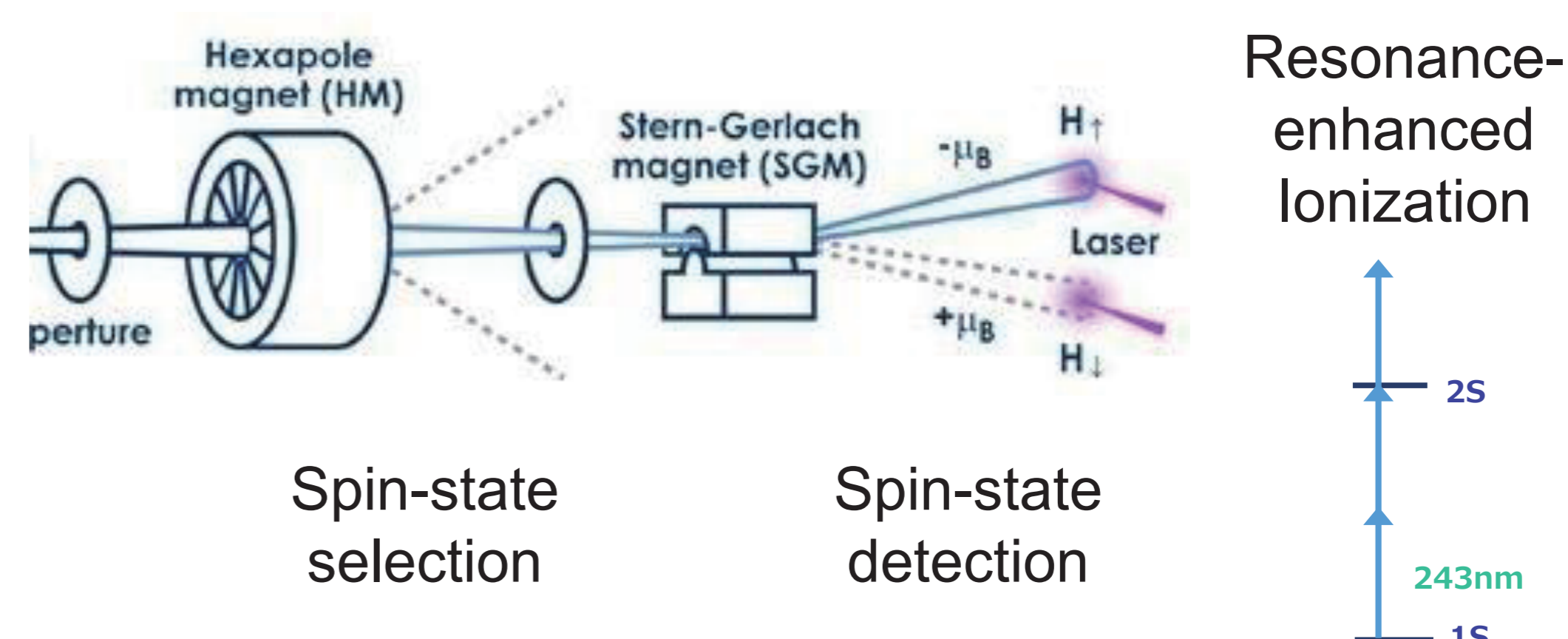


#### 3D imaging of H in materials



#### [Spin-polarized H and Laser spectroscopy]

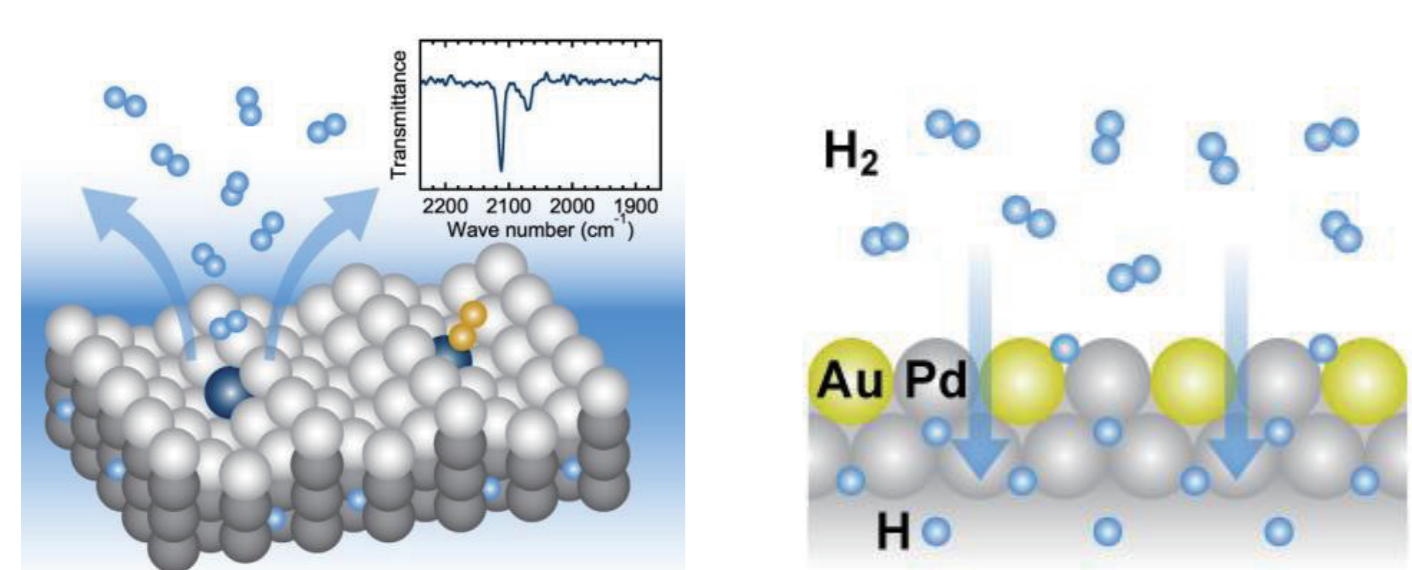
Spin conversion, rotational relaxation, spin-dependent reactions



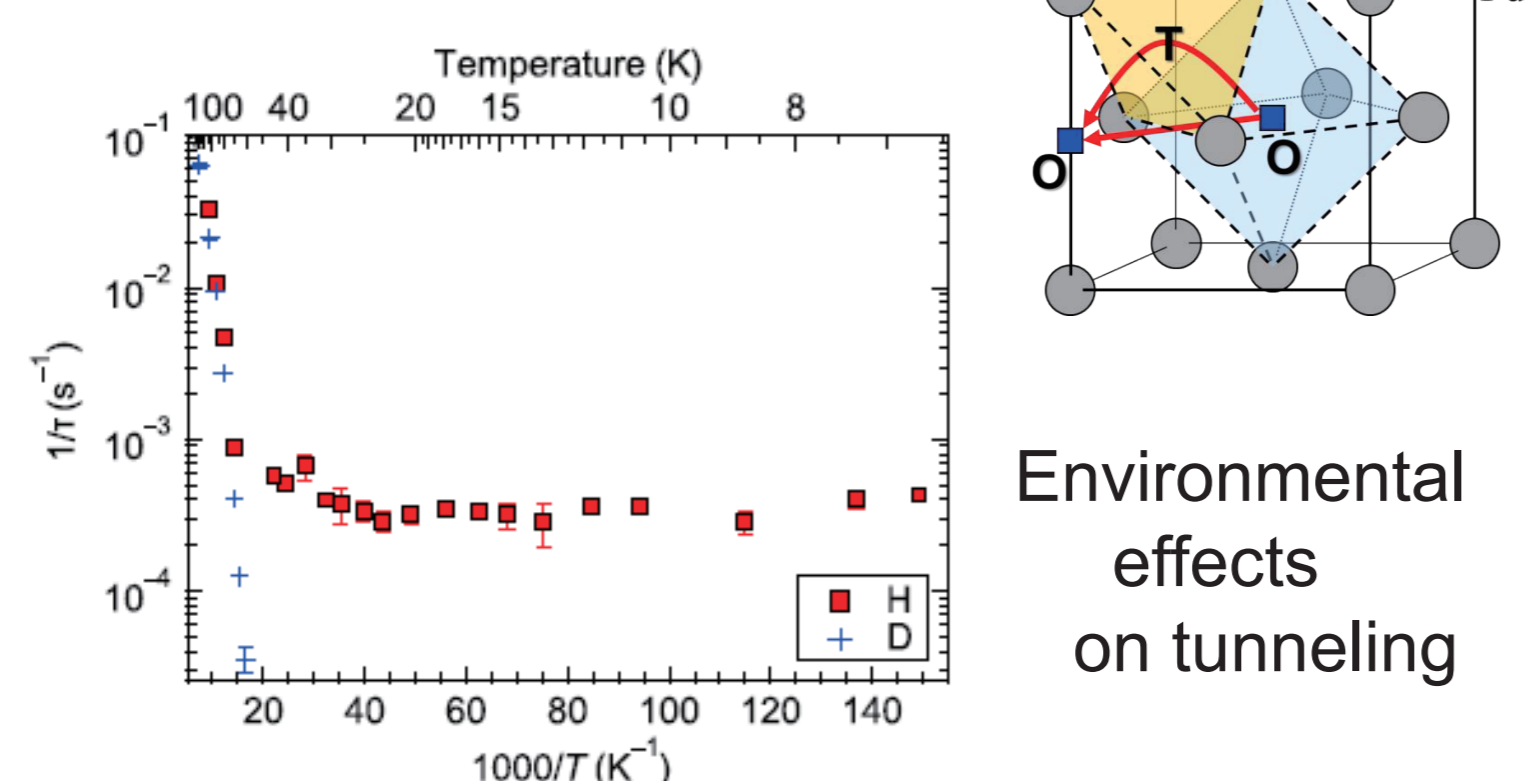
Photoemission, Thermal desorption, Infrared-absorption spectroscopy, STM, etc.

### Dynamics of protons, electrons, and spins

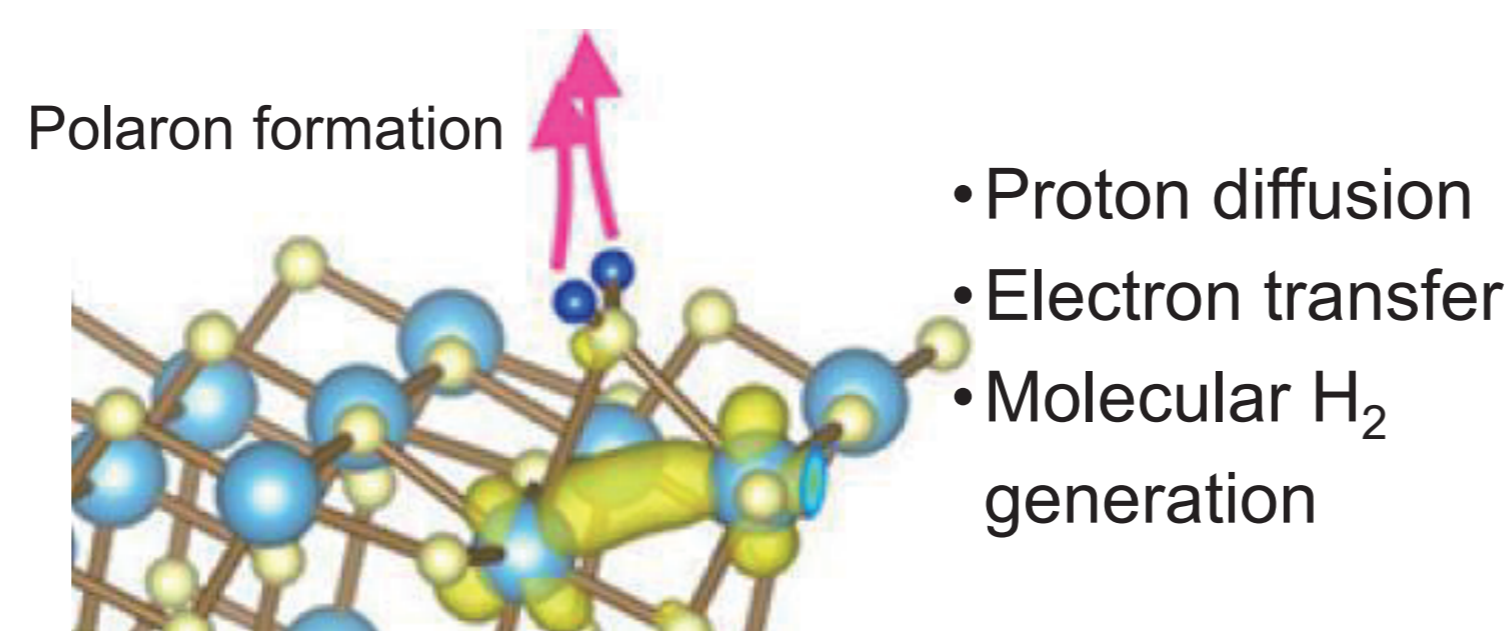
#### Control of H transport by surface modification



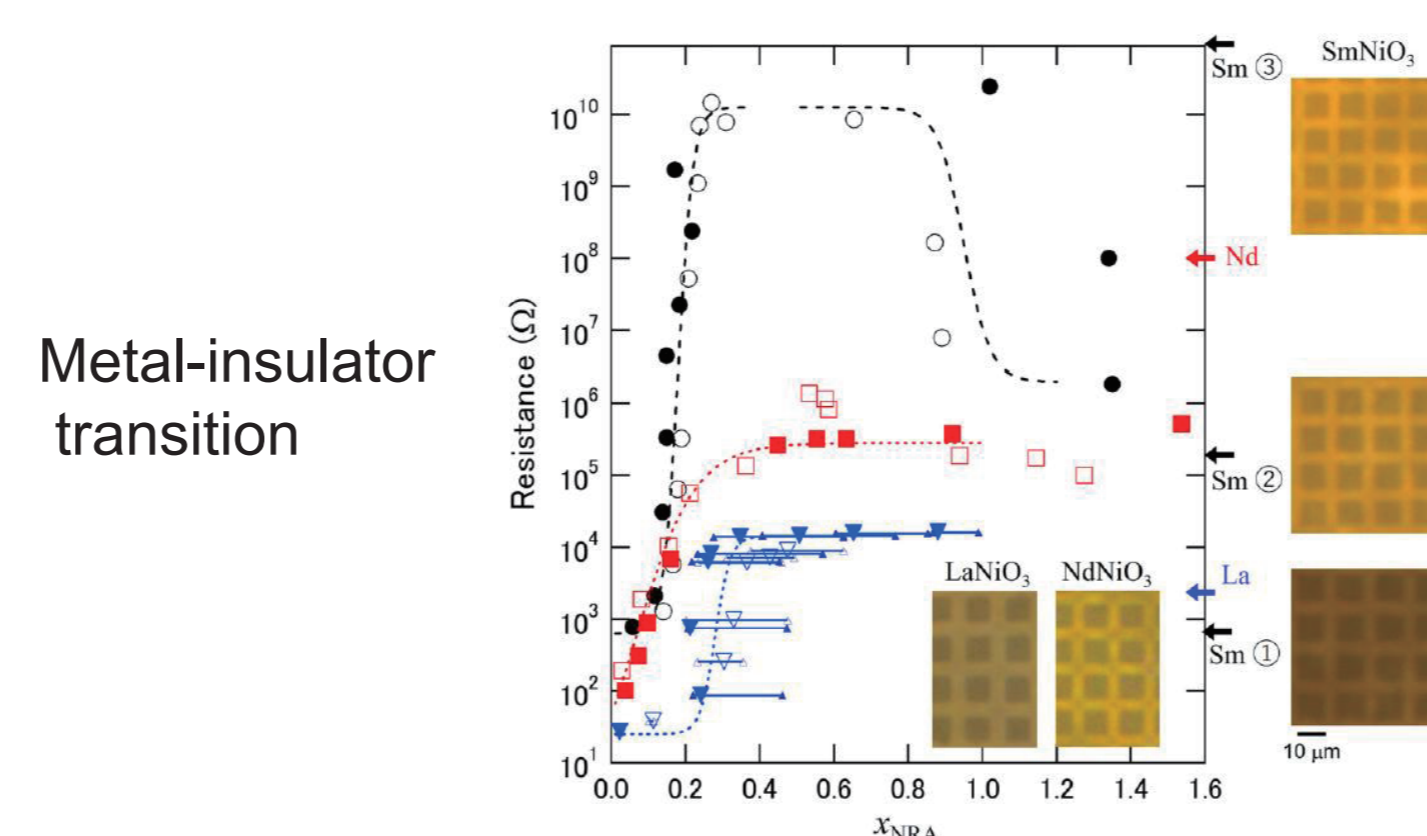
#### Quantum diffusion of H



#### Hydrogen dynamics on TiO<sub>2</sub>



#### Proton-induced dynamic modulation



#### Hindered quantum rotation and nuclear-spin conversion

