

Friday, July 03, 2026 

14:00 h 

RUN Auditorium 



## Dr. Bruno Schuler

Empa, Swiss Federal Laboratories for  
Materials Science and Technology  
Dübendorf, Switzerland

### ***Probing atomic defects in 2D semiconductors with light-coupled STM***

Two-dimensional (2D) semiconductors provide an exciting platform to engineer atomic quantum systems in a robust, yet tunable solid-state system. This talk explores the intriguing physics of single point defects in transition metal dichalcogenide (TMD) monolayers, investigated through atomically resolved scanning probe microscopy.

We demonstrate electrically induced exciton emission from both pristine MoS<sub>2</sub> and individual charged defects using scanning tunnelling microscope luminescence (STML) on ultrathin hBN decoupling layers. Furthermore, I will present our recent advances in time-resolved THz-STM using quantum efficiency vs. voltage (QEV) maps to achieve state-selective ultrafast charge injection. This approach enables the investigation of charge and exciton dynamics with atomic spatial, millielectronvolt energy, and picosecond temporal resolution.

By combining the structural and electronic properties accessible by conventional scanning probe microscopy with the optical fingerprint from STML and the excited-state dynamics revealed through pump-probe THz-STM, we gain a comprehensive microscopic understanding of localized quantum states in low-dimensional materials.

Coffee & Discussion