



TECHNISCHE UNIVERSITÄT  
IN DER KULTURHAUPTSTADT EUROPAS  
CHEMNITZ

# Institut für Physik Physikalisches Kolloquium



**Donnerstag, 17.04.2025, 15:30 Uhr**

Ort: Reichenhainer Str. 90;

Zentrales Hörsaal- und Seminargebäude, Raum C10.013

**Prof. Dr. Maria Antonietta Loi**

Zernike Institute for Advanced Materials,  
University of Groningen (Niederlande)

## COLLOIDAL QUANTUM DOT SUPERLATTICES: TOWARDS OPTOELECTRONIC METAMATERIALS

3D superlattices made of colloidal quantum dots are a promising candidate for the next generation of optoelectronic devices as they are expected to exhibit a unique combination of tunable optical properties and coherent electrical transport through minibands. In my presentation I will show the fabrication of 3D superlattices of PbSe (Fig. 1) and PbS QDs with nanoscale-level controlled ordering over large areas [1, 2], and of outstanding transport properties. The measured electron mobilities for PbSe superlattices are the highest ever reported for a self-assembled solid of fully quantum-confined objects (electron mobility up to  $278 \text{ cm}^2 \text{ V}^{-1} \text{ s}^{-1}$ ). This ultimately demonstrates that optoelectronic metamaterials with highly tunable optical properties (in this case in the short-wavelength infrared spectral range) and charge mobilities approaching that of bulk semiconductor can be obtained. This finding paves the way toward a new generation of optoelectronic devices

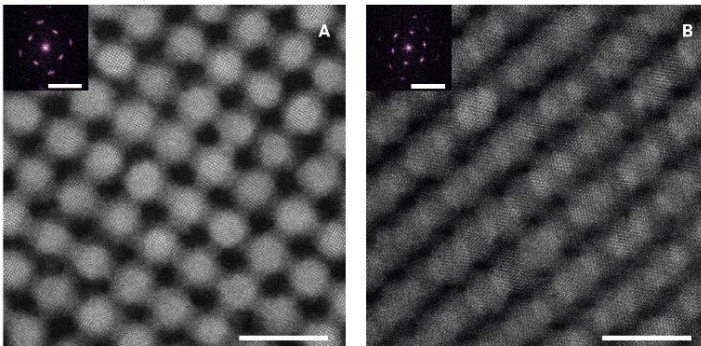


Figure 1. Atomic-resolution electron microscopy imaging. (A) HR STEM-HAADF micrographs of the  $\text{SC}\{100\}_{\text{SL}}$  and (B)  $\text{Rh}\{110\}_{\text{SL}}$  phases as found in the 3 and 8 layers samples after LE. Insets: FFTs (Scale bars 10 nm, inset  $10 \text{ nm}^{-1}$ ).

[1] J. Pinna, R. Mehrabi Koushki, D. S. Gavhane, M. Ahmadi, S. Mutalik, M. Zohaib, L. Protesescu, B. J. Kooi, G. Portale, M. A. Loi, *Approaching Bulk Mobility in PbSe Colloidal Quantum Dots 3D Superlattices*. *Adv. Mater.*, 35, 2207364 (2023).

[2] J. Pinna, E. Pili, R. Mehrabi Koushki, D. S. Gavhane, F. Carlà, B. J. Kooi, G. Portale, and M. A. Loi *PbI<sub>2</sub> Passivation of Three Dimensional PbS Quantum Dot Superlattices Toward Optoelectronic Metamaterials* *ACS Nano*, 18, 29, 19124 (2024).



Alle Zuhörer sind ab 15:15 Uhr zum Kaffee vor dem Hörsaal eingeladen.