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TWO-DIMENSIONAL COLLOIDAL QUANTUM WELLS FOR FUTURE PHOTONIC SOURCES

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HCI H 2, 17.00 h

Project Summary: Miniaturized photonic sources based on semiconducting two-dimensional (2D) materials offer new technological opportunities beyond the modern III-V platforms. For example, the quantum-confined 2D electronic structure aligns the exciton transition dipole moment, directing emission perpendicular to the surface. It requires decoupled multiple-quantum-well (MQW) superlattices, in which individual 2D material layers are isolated by atomically thin quantum barriers (QBs). During my PhD, I developed synthetic routes to obtain monodispersed, quantum-confined colloidal quantum wells (CQWs) of lead halide perovskites with precise thickness control and therefore a tunable band gap, followed by successfully fabricating thin-film MQW superlattices out of these materials. Unexpectedly, an enhancement of PLQY with respect to colloidal dispersions was observed, and individual QWs can be decoupled with unprecedentedly ultrathin QBs that screen interlayer interactions within the range of 6.5 Å. The findings reported here lay the foundation for many near- and far-field applications such as nanoantennas and light-emitting diodes.

CV: Jakub received his BSc in Chemical Engineering and MSc in Chemical- and Bioengineering from ETH Zurich. In 2016 he joined the group of Prof. Chih-Jen Shih to pursue his PhD degree.

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