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Probing Energy Levels of Large Array Quantum Dot Superlattice by Electronic Transport Measurement S.Z. BISRI, RIKEN-CEMS, Japan, E. DEGOLI, UNIMORE, Italy, N. SPALLANZANI, Univ.Rome II, Italy, G. KRISHNAN, B. KOOI, Univ.Groningen, Netherlands, C. GHICA, NIMP-Bucharest, Romania, M. YAREMA, Univ.Linz, Austria, L. PROTESESCU, ETHZurich, Switzerland, W. HEISS, Univ.Linz, Austria, M. KOVALENKO, ETHZurich, Switzerland, O. PULCI, Univ.Rome II, Italy, S. OSSICINI, UNIMORE, Italy, Y. IWASA, RIKEN-CEMS, Japan, M.A. LOI, Univ.Groningen, Netherlands — Colloidal quantum dot superlattice (CQDS) emerges as new type of hybrid solids allowing easy fabrication of devices that exploits the quantum confinement properties of individual QD. This materials displays peculiar characters, making investigation of their transport properties nontrivial. Besides the bandgap variations, 0D nature of QD lead to the formation of discrete energy subbands. These subbands are crucial for multiple exciton generation (for efficient solar cell), thermoelectric material and multistate transistor. Full understanding of the CQDS energy level structure is vital to use them in complex devices. Here we show a powerful method to determine the CQDS electronic energy levels from their intrinsic charge transport characteristics. Via the use of ambipolar transistors with CQDS as active materials and gated using highly capacitive ionic liquid gating, Fermi energy can be largely tuned. It can access energy levels beyond QD's HOMO & LUMO. Ability to probe not only the bandgap, but also the discrete energy level from large assembly of QD at room temperature suggests the formation of energy minibands in this system.

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