Structural and optoelectronic properties of 2D multilayered perovskites and 2D/3D bilayers for photovoltaics

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2D multilayered metal halide perovskites share similarities with 3D perovskites including direct electronic band gap, sizeable optical absorption, small effective masses, Rashba-like effects [1]. They exhibit other attractive features related to tunable quantum and dielectric confinements, strong lattice anisotropy, more complex combinations of atomic orbitals and lattice dynamics, extensive chemical engineering possibilities, including chiral cations. This will be illustrated by recent combined experimental and theoretical studies on excitons, formation of edge states, hot carrier effects and carrier localization [2-7]. Moreover, combined in 2D/3D bilayer structures using new versatile growth methods, excellent solar cell device stability has been demonstrated [8]. The difference of performances between n-i-p or p-i-n device architecture can be rationalized based on band alignment calculations [9]. Noteworthy, the concept of lattice mismatch provides guidance for choosing the 2D and 3D materials to combine [10].

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