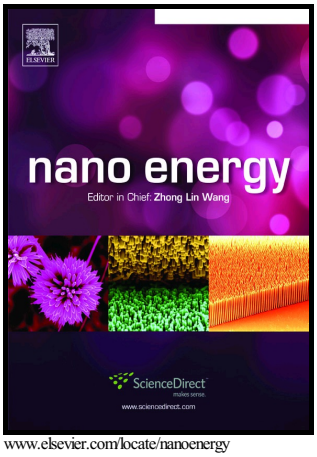
Giant blueshifts of excitonic resonances in two-dimensional lead halide perovskite

Can Huang, Yisheng Gao, Shuai Wang, Chen Zhang, Ningbo Yi, Shumin Xiao, Qinghai Song



www.elsevier.com/locate/nanoenergy

PII: S2211-2855(17)30595-5
DOI: http://dx.doi.org/10.1016/j.nanoen.2017.09.048
Reference: NANOEN2224

To appear in: *Nano Energy*

Received date: 14 July 2017
Revised date: 9 September 2017
Accepted date: 25 September 2017

Cite this article as: Can Huang, Yisheng Gao, Shuai Wang, Chen Zhang, Ningbo Yi, Shumin Xiao and Qinghai Song, Giant blueshifts of excitonic resonances in two-dimensional lead halide perovskite, *Nano Energy,* http://dx.doi.org/10.1016/j.nanoen.2017.09.048

Giant blueshifts of excitonic resonances in two-dimensional lead halide perovskite

Can Huang[1,†], Yisheng Gao[1,†], Shuai Wang[1], Chen Zhang[1], Ningbo Yi[1], Shumin Xiao[1,2,#], Qinghai Song[1,2,*]

[1.] State Key Laboratory on Tunable laser Technology, Ministry of Industry and Information Technology Key Lab of Micro-Nano Optoelectronic Information System, Shenzhen Graduate School, Harbin Institute of Technology, Shenzhen, China, 518055.

[2.] Collaborative Innovation Center of Extreme Optics, Shanxi University, Taiyuan 030006 China.

Corresponding to: * qinghai.song@hit.edu.cn; # Shumin.xiao@hit.edu.cn

† These authors contribute equally to this research.

Abstract:

Two-dimensional (2D) methylammonium lead halide perovskites ($MAPbX_3$) have gained intensive research attention in past two years. Due to their quantum and dielectric confinements, 2D $MAPbX_3$ exhibited giant exciton binding energy, increased bandgap, and blueshifts of photoluminescence. Some of these novel characteristics have been successfully utilized to improve the performances of optoelectronic devices. However, up to now, the studies of quantum confinements are restricted within the linear region. Lots of important effects in quantum systems such as the exciton-exciton interaction have never been considered. Herein we synthesized the 2D $MAPbBr_3$ nano-sheets with layer number n = 7-10, 5, 3, 1 and characterized their nonlinear optical properties under high excitation density. Due to the strong excitonic resonance, we have achieved significantly increased third-harmonic generation (THG) from the 2D $MAPbBr_3$ nano-sheets. The deduced χ^3 of few-layer $MAPbBr_3$ nano-sheets was more than 50 times larger than the bulk $MaPbBr_3$ microblocks. While the THG was strongly dependent on the excitonic resonance, we found that their peak wavelengths were different from the ones of excitons in linear absorption