Electronic Supplementary Information

Title

Low-Threshold Amplification of Spontaneous Emission from $AgInS_2$ Quantum Dots

Authors

Qian Xiong,[ade] Jinlong Yang,[c] Huaiyi Ding,[c] Juan Du, *[a] Xiaosheng Tang, *[b] Tongchao Shi,[a] Zhengzheng Liu,[a] Daofu Wu,[b] Hao Lin[b] and Yuxin Leng*[ade]

Institutions

[a] State Key Laboratory of High Field Laser Physics, Shanghai Institute of Optics and Fine Mechanics, Chinese Academy of Sciences, Shanghai 201800, China.

[b] Key Laboratory of Optoelectronic Technology and Systems (Ministry of Education) College of Optoelectronic Engineering, Chongqing University, Chongqing 400044, China.

[c] Department of Physics, University of Science and Technology of China, Hefei 230026, China.

[d] School of Physical Science and Technology, ShanghaiTech University, Shanghai 200031, China.

[e] Center of Materials Science and Optoelectronics Engineering, University of Chinese Academy of Sciences, Beijing 100049, China.

*Corresponding authors: dujuan@mail.siom.ac.cn, xstang@cqu.edu.cn, lengyuxin@mail.siom.ac.cn

Table S1. Time-resolved PL decays for AIS QDs below threshold and above threshold.

	T_1 (ps)	T_2 (ps)
Below threshold	900	29000
Above threshold	500	8000

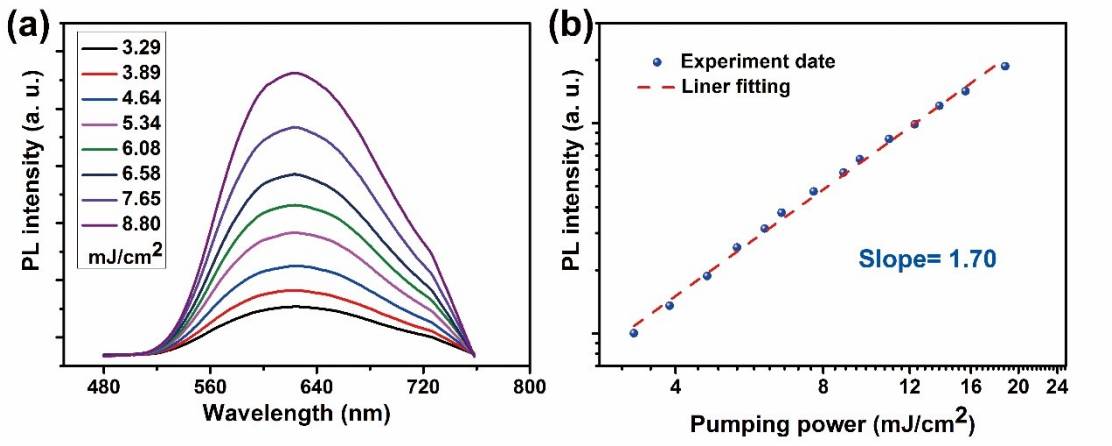

Figure S1. (a) Increasing power-dependent two photo induced PL intensity of AIS QDs. (b) A log−log plot of quadratic dependence of two photo PL intensity vs pumping power.

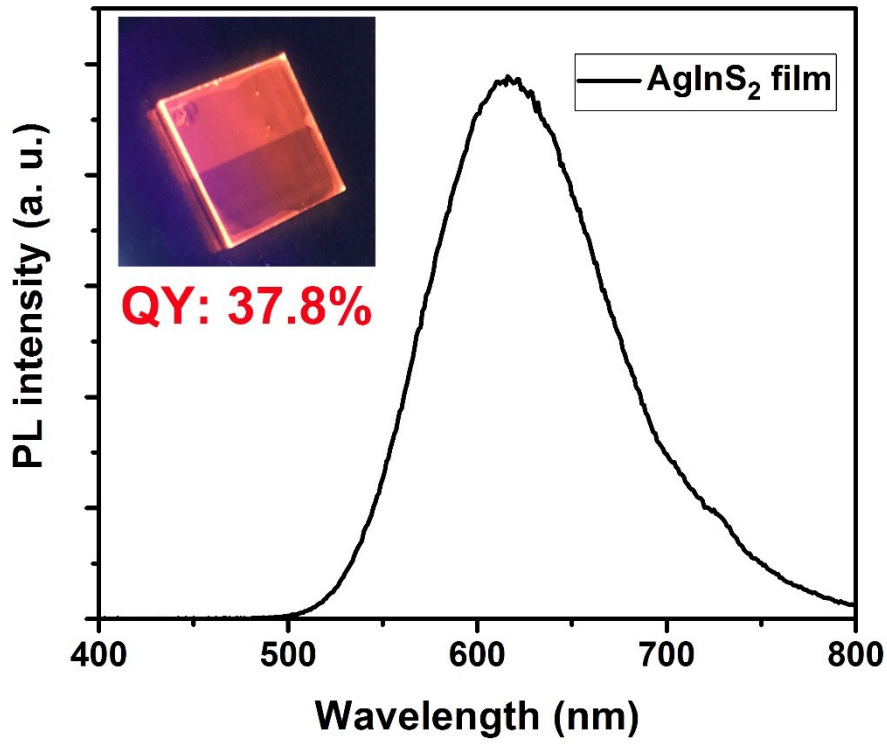

Figure S2. The PL spectroscopy of AIS film.

The whole process of fabricating the devices is listed in detail as follow.

At first, we sputtered SiO_2 and TiO_2 on a transparent quartz plate by magnetron sputtering. The thickness of SiO_2 is 106 nm, and the thickness of TiO_2 is 66 nm. Three pairs are sputtered to form the upper DBR shown in the **Figure S3a**. Secondly, we alternately sputtered SiO_2 and TiO_2 on the Si wafer by magnetron sputtering. The thickness of SiO_2 is 106 nm, and the thickness of TiO_2 is 66 nm. Seven pairs are sputtered to form the lower DBR shown in the **Figure S3b**. Thirdly, we spin-coated quantum dots on the upper DBR, where the speed is 4000 rpm for 60 s shown in the **Figure S3c**. Finally, the upper layer of DBR is reversely buckled on the lower layer of DBR, and the optical epoxy glue was dripped around, then the upper part is covered with a heavy object and it was left to stand at room temperature for 24 hours. After the glue is solidified, we wipe away the excess glue. It is displayed in the **Figure S3d**.

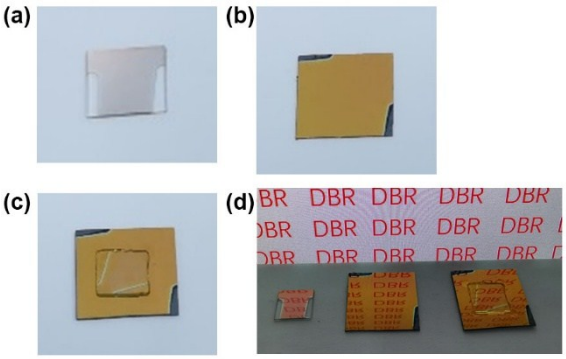

Figure S3. The whole process of fabricating the device.

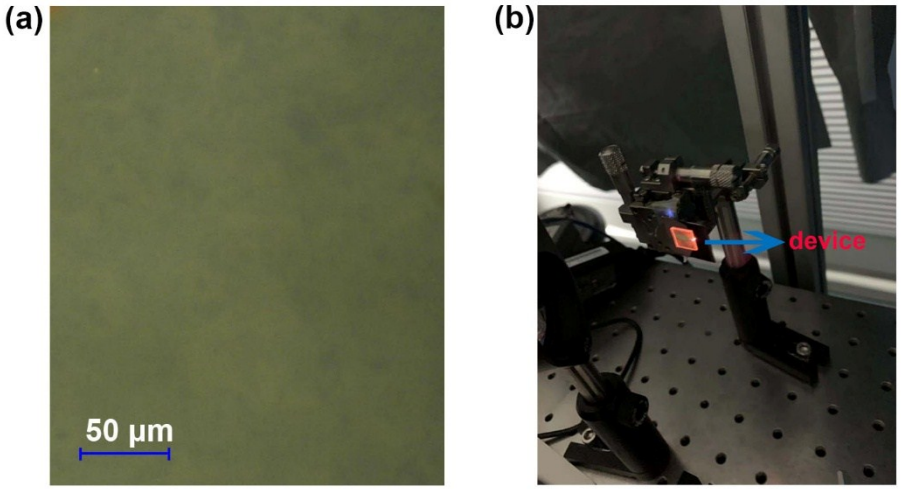

Figure S4. (a) The micrograph of the AIS QD film. (b) Photographic image of the output spot from the $AgInS_2$ device.

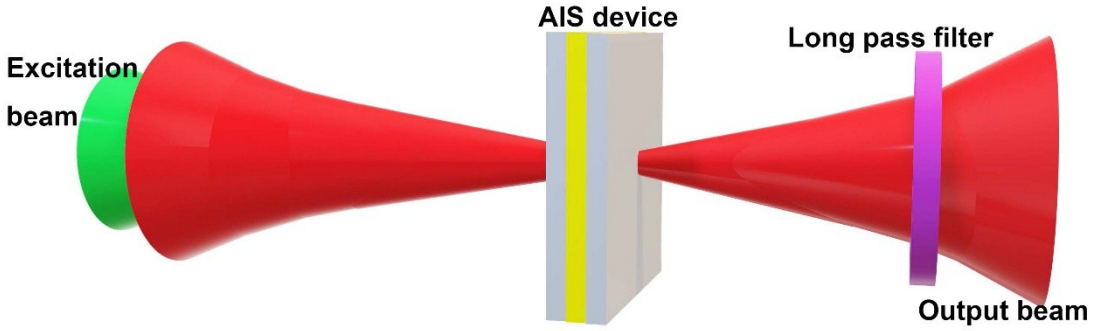

Figure S5. Schematic of a vertically pumped AIS device with a long pass filter to remove any residual pump excitation beam as much as possible.

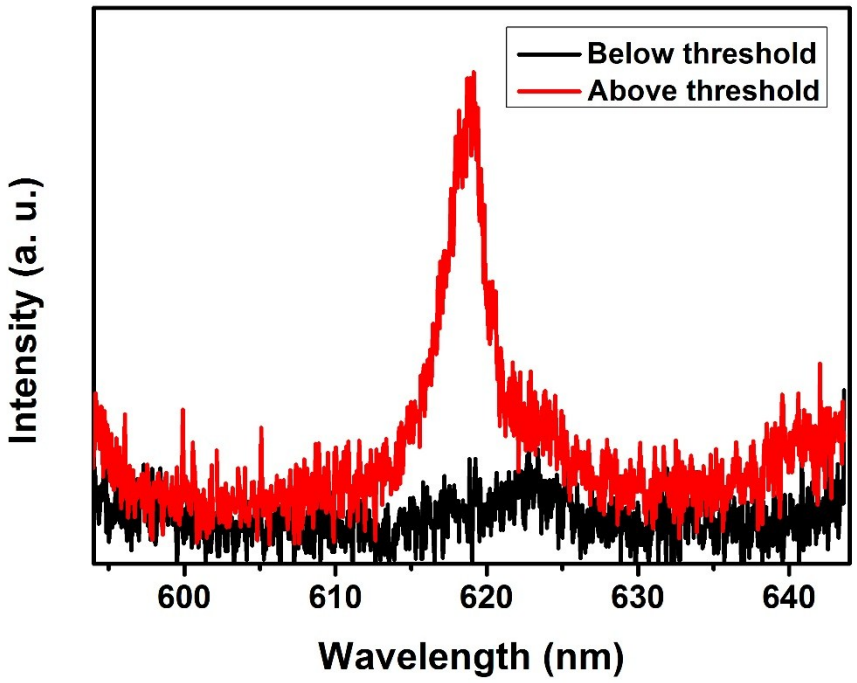

Figure S6. Emission spectra from the AIS devices below and above the threshold.

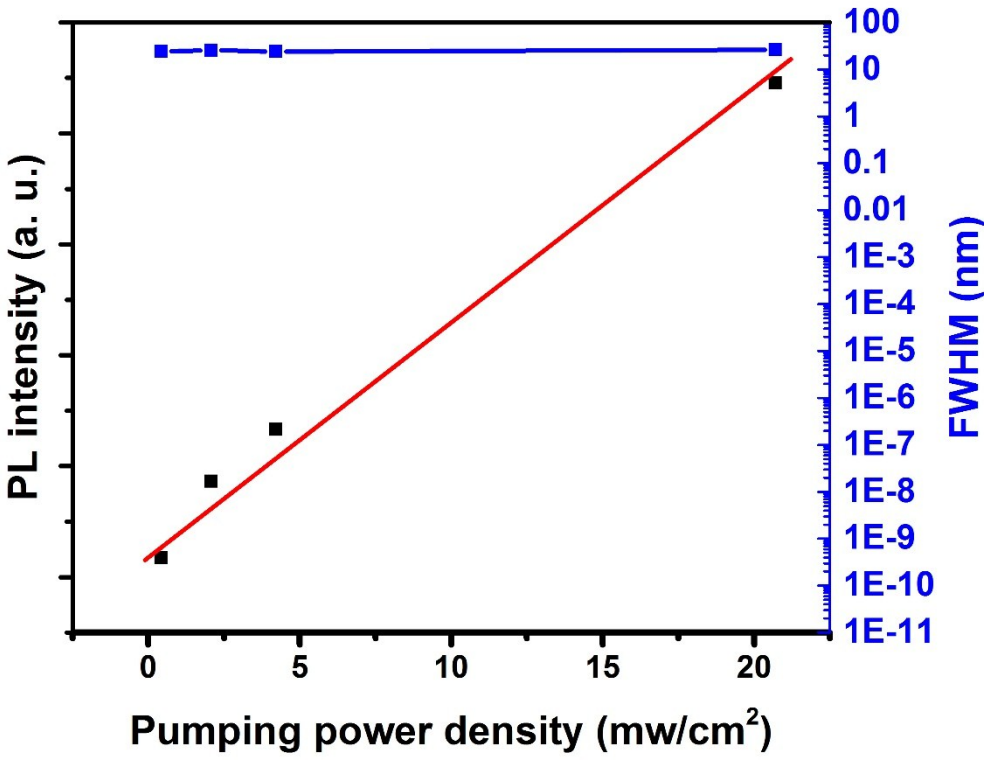

Figure S7. L−L curve and the change of FWHM for one layer DBR.

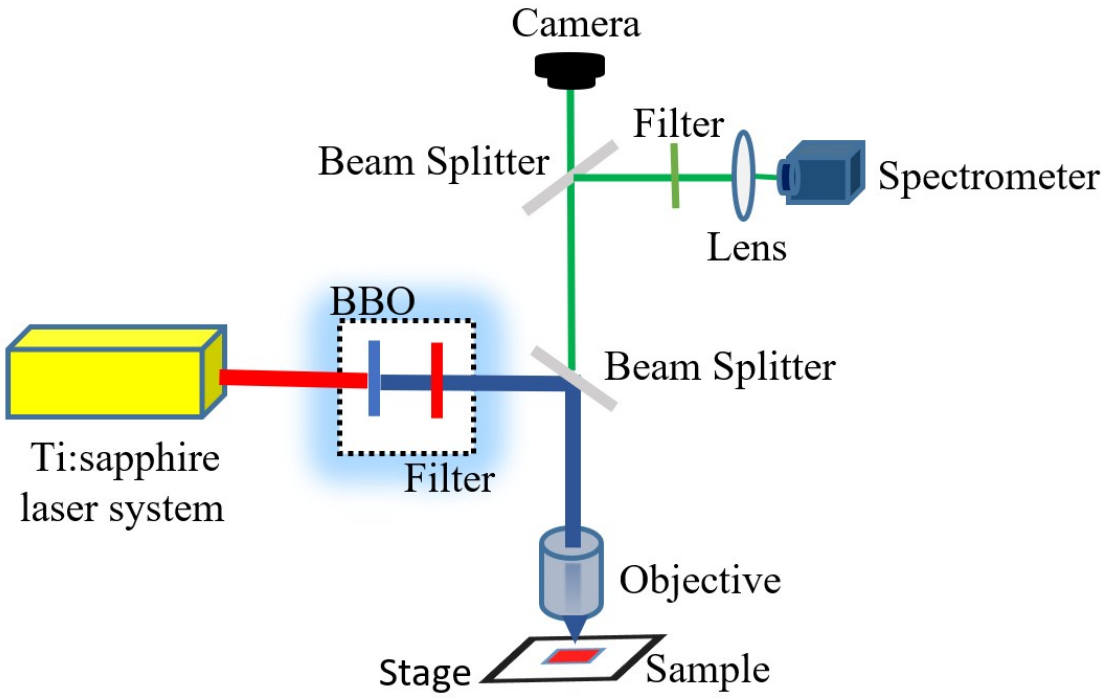

Figure S8. A figure with the experimental set-up.