北京大学量子材料科学中心

International Center for Quantum Materials, PKU

Weekly Seminar

Exciton Polaritons of Halide Perovskite Semiconductor Crystals

Qing Zhang

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Time: 4:00pm, Sept. 30, 2020 (Wednesday)

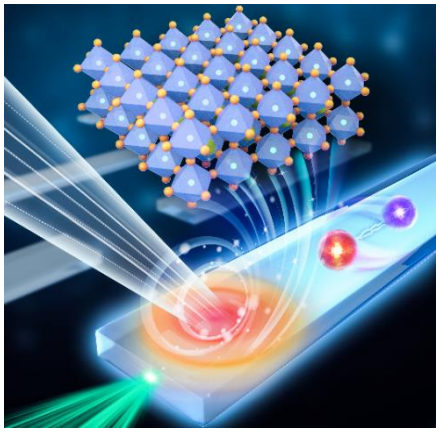
时间：2020年9月30日 （周三）下午4:00

Venue: Room W563, Physics building, Peking University

地点：北京大学物理楼，西563会议室

Abstract

Recently, metal-halide perovskite semiconductors have attracted tremendous attentions owing to their promising potentials for the next generation information and optoelectronic functional devices. Besides, benefitted from the large exciton oscillator strength and binding energy, pervoskites provide an ideal platform to explore the exciton polaritons (EPs), a quasi-particle in strong coupling regime, and their condensation at room temperature[1]. In this literature, I will present our recent progresses on exploring EPs in halide perovskite and its correlated role in continuous wave (CW) pumped microlaser. In 2018, we firstly designed a $MAPbBr_3$ nanowire-SiO_2-Ag microcavity structure to introduce the surface plasmon polariton, which effectively increased the number of localized oscillators and further enhanced the Rabi splitting energy to ~564 meV. Latterly, we explored the propagating behaviors of EPs and the dielectric properties in $CsPbBr_3$ nanowire at room temperature. It suggests the present of EPs enhances the group refractive index (n_g) and optical absorption coefficient compared with bulk counterparts[3]. Besides, n_g could reach 43.7 as temperature drops, which significantly increases the mode confinement factor, reduces the optical losses, and thus lowers the lasing threshold. Eventually, we realized CW pumped green microlaser in ultrathin $CsPbBr_3$ nanoribbons on sapphire substrate[4]. In the last part of this talk, I will prospect the future research interests of EPs in perovskite crystals.



References

1. R. Su, Q. Xiong* et al., Observation of exciton polariton condensation in a perovskite lattice at room temperature. Nat. Phys. 16, 301–306 (2020).
2. Q. Shang, Q. Zhang* et al., Surface Plasmon Enhanced Strong Exciton–Photon Coupling in Hybrid Inorganic–Organic Perovskite Nanowires. Nano Lett. 18, 3335-3343 (2018).
3. Q. Shang, Q. Zhang* et al., Enhanced Optical Absorption and Slowed Light of Reduced-Dimensional $CsPbBr_3$ Nanowire Crystal by Exciton–Polariton. Nano Lett. 20, 1023-1032 (2020).
4. Q. Shang, Q. Zhang* et al., Role of the Exciton–Polariton in a Continuous-Wave Optically Pumped $CsPbBr_3$ Perovskite Laser, Nano Lett. 20, 6636–6643 (2020).

About the speaker

Dr. Qing Zhang is an assistant professor of Department of Materials Science and Engineering, College of Engineering, Peking University. She received the bachelor degree in Materials Physics from University of Sciences and Technology of China in 2005 and doctoral degree in Physics from Tsinghua University (Supervisor: Prof. Qikun Xue) in 2011. She had worked as a postdoctoral research fellow (Supervisor: Prof. Qihua Xiong) in Nanyang Technological University in 2011-2016. Since 2016, she joined in Peking University as a principle investigator and assistant professor. Her research interests include the light-matter interaction, optical spectroscopy of low-dimensional semiconductor materials, and optoelectronic functional devices. Currently, she published nearly 100 papers in journals such as Nature Photonics, Nature Communications, Nano Letters, Advanced Materials, and Physical Review Letters. Besides, she has worked as session chair in PIERS 2018 (Japan), ICMAT 2019 (Singapore), and guest editor for Chinese Laser Journal, SCIENCE CHINA Materials, and Photonics Research. She is also a member of Youth Working Committee on Chinese Materials Society and obtained Young Scientist Award of Nanochemistry committee of Chinese Chemistry Society.