Strong Light-Matter Interactions in 2D Materials for Optoelectronic Devices

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Abstract

The exploration of semiconductor materials for applications in optoelectronic devices such as efficient solar cells, low-threshold lasers, and bright light emitting diodes are some of the continuous efforts among materials scientists, physicists, and chemical engineers. Often new materials possessing unique optical properties with feasibility for device integration falls under the emerging semiconductors domain. Recently two-dimensional (2D) semiconductors with strong exciton binding energy at room temperature have shown promise in solar energy harvesting and low-threshold lasers. Nevertheless, the large bandgap in 2D materials compared to their 3D counterparts limits their application in solar cells.

In this talk, I will discuss recent advancements in 2D materials and how strong coupling can overcome intrinsic limitations.[1,2] I will introduce a simple gold/perovskite heterostructure that absorbs photons below the semiconductor's bandgap and can be integrated into solar cells with existing electron/hole transport layers.[3] This strong coupling enhances solar cell performance and pave way for novel device concepts. Finally, I will conclude the talk on ultrastrong coupling in the 2D materials which can lead to low-threshold lasers with a narrow linewidth.[4]

References

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Figures

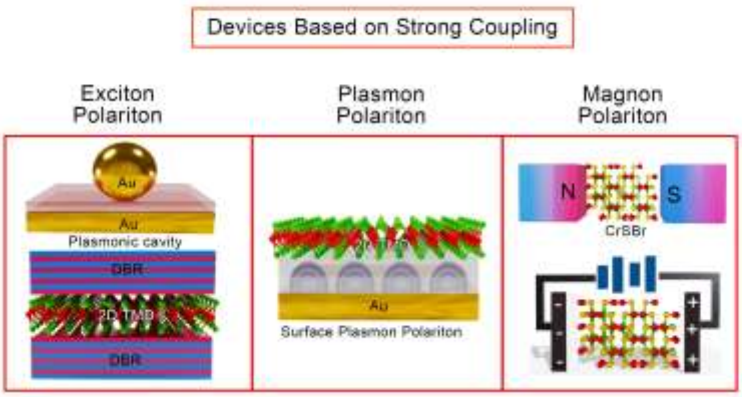

Figure 1: Strong Light-Matter Interaction for Optoelectronic Devices