Carrier amplification via triplet exciton extraction in van der Waals layered heterostructure

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A major challenge to improve solar energy harvesting efficiency lies in the efficient use of the excess energy of hot carriers generated by photoexcitation. To efficiently utilize the excess energy, carrier multiplication in inorganic semiconductors and singlet fission in organic materials have been attempted. Both processes are able to generate two or more electron-hole pairs by a single photon absorption, and are very promising to exceed the Shockley-Queisser limit theoretically. In this talk, we will present carrier multiplication in 2D materials with the lowest threshold energy and the highest conversion efficiency among the published results so far. Also, we will show that our new strategy can boost the carrier population in transition metal dichalcogenides/organic semiconductor type II heterostructure, which will be a breakthroughs for 2D-based solar cells.

References

[1] Ji-Hee Kim et al., Carrier multiplication in van der Waals layered transition metal dichalcogenides, Nature Communications 10, 5488 (2019)