Nonlinear Optics of Two-dimensional Layered Materials

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Abstract

Two-dimensional layered materials (2DLMs), such as graphene and transition metal dichalcogenide monolayers, have recently stimulated great interest [1], promising for ultrafast and broadband applications such as frequency conversion and ultrafast pulse generation [2,3]. Moreover, attributed to their unique properties (e.g., strong excitonic effect), 2DLMs show fascinating nonlinear optical properties [1,4]. Here, I will present our results on nonlinear optics with 2DLMs, including harmonic generation (Figure 1) [5-8] and wave-mixing [9]. Further, I will discuss our recent nonlinear optical advances in 2DLM-based hybrid structures (such as plasmon-2DLMs).

References

- [1] A. Autere, et al., Adv. Mater., 30(2018), 1705963.
- [2] Z. Sun et al., Nat. Photon., 10(2016), 227; A. Martinez et al., Nat. Photon. 7,842(2013).
- [3] D. Li, et al., Sci. Rep., 5(2015), 15899; D. Li, et al., 2D mater., 4(2017), 025095.
- [4] Z. Sun, Nat. Photon. 12(2018), 383-385.
- [5] A. Säynätjoki et al., Nat. Commun., 8(2017),893.
- [6] L. Karvonen et al., Nat. Commun., 8(2017),15714.
- [7] A. Autere et al., J. Phys. Chem. Lett. 8(2017), 1343.
- [8] A. Autere, et al., Phys. Rev. B, 98(2018),115426.
- [9] Y. Dai, et al., "Gate-tunable nonlinear optics in MoS₂", Submitted (2020).

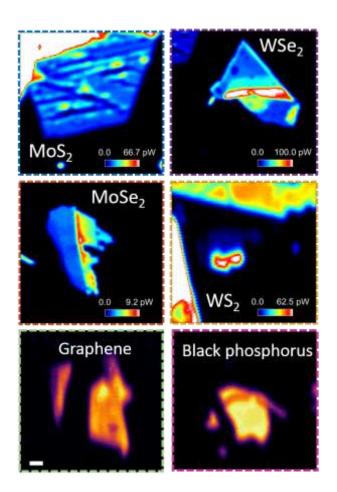


Figure 1: Third-harmonic generation images of different 2DLMs [1,7].

Figures