Optical crystals of 2D materials

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Nonlinear optical crystals are the key components in advancing laser technology, offering the crucial functionalities of frequency conversion, signal modulation and parameter amplification. Over the last few decades, the utilization of well-established materials for nonlinear optical crystals like BBO, $LiNbO_3$, and KBBF has contributed to the fast development of quantum light sources, photonic integrated circuits and ultrafast lasers. The pursuit of suitable nonlinear optical crystals has led the exploration of the potential in two-dimensional (2D) materials, in which rhombohedral boron nitride (rBN) is particularly promising due to its high nonlinear susceptibility, broadband transparency, remarkable physicochemical stability, and compatibility with Si-based optical chips. However, the preparation of large-sized single-crystal rBN layers remains an extreme challenge. In this talk, I will introduce some recent progresses in the growth of large single-crystal rBN layers with both in-plane and out-of-plane controls[1-3], as well as the development of the twist-phase-matching theory for the design of 2D nonlinear optical crystals[4]. Twisted rBN will be a new useful optical crystal for future photonic and optoelectronic applications.

References:

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