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Disentangling lattice and electronic instabilities in the excitonic insulator candidate Ta_2NiSe_5 by nonequilibrium spectroscopy

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Ta2NiSe5 (TNS) is an excitonic insulator candidate showing the semiconductor/semimetal-to-insulator (SI) transition below Tc=326 K. However, since a structural transition accompanies the SI transition, deciphering the role of electronic and lattice degrees of freedom in driving the SI transition has remained controversial. Here, I will present an investigation of the photoexcited nonequilibrium state in TNS using pump-probe Raman and photoluminescence (PL) spectroscopies. The combined nonequilibrium spectroscopic measurements of the lattice and electronic states reveal the presence of a photoexcited metastable state where the insulating gap is suppressed, but the low-temperature structural distortion is preserved. We conclude that electron correlations play a vital role in the SI transition of TNS.

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