# Unveiling Mechanism of Temperature-Sensitive Self-Trapped Exciton Emission in One-Dimensional Hybrid Organic-Inorganic Tin Halide

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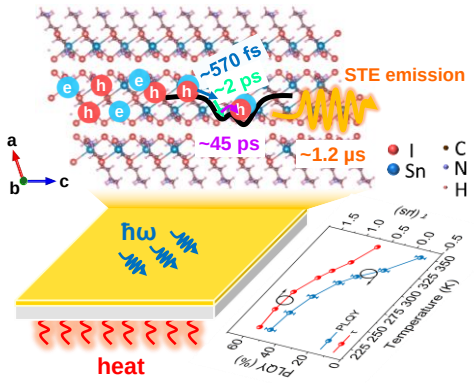
Lead-free hybrid metal halides showing self-trapped exciton (STE) emission have been recently explored for thermography due to their strong temperature dependence of photoluminescence (PL) lifetime (τ),[1, 2] however, the underlying mechanism governing the thermal quenching of STE remains elusive. Herein, we investigated a homogeneous one-dimensional $ODASn_2I_6$ (ODA, 1,8-octanediamine) nm-scale thin film exhibiting efficient STE emission. The PL decay shows a strong temperature dependence from 275 K (τ ~ 1.31 μs) to 350 K (τ ~ 0.65 μs) yielding a thermal sensitivity of 0.014 $K^{-1}$. By employing temperature-dependent transient absorption spectroscopy, we obtained a detailed detailed information about the relaxation processes prior to the STE formation (See below Scheme). Simultaneous analyses of steady-state and time-resolved spectroscopies lead to a self-consistent model where a thermally activated phonon-assisted nonradiative pathway explains the temperature dependence of the PL lifetime via a conical intersection between the ground state and STE potential energy surfaces. These findings offer a deep understanding of temperature-dependent STE dynamics in low-dimensional metal halides.




**Scheme:** The mechanism summary illustrating the dynamics of temperature-sensitive STE in nm-scale $ODASn_2I_6$ thin film.

**Acknowledgments**
We acknowledge financial support from the Swedish Energy Agency (Grant 50709-1) and the Swedish Research Council VR (2021-05207). Y. H. also acknowledges funding support from the China Scholarship Council (No. 202006150002). J. C. acknowledges funding support from the Novo Nordisk Foundation (NNF22OC0073582).

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