Active tuning of light-matter interactions in heterostructure 2D materials
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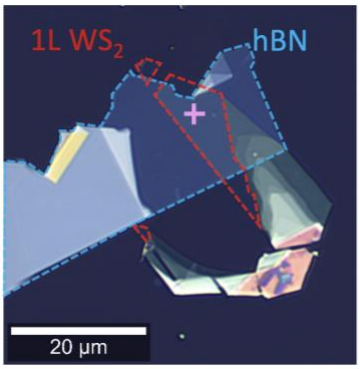
Since the isolation of graphene in 2004, more than two thousand layered 2D materials have been identified. These materials can be exfoliated from bulk down to atomically thin monolayers, which exhibit unique optical and electronic properties. By employing a deterministic stamping technique, different 2D materials can be stacked on top of each other to create heterostructures with designed properties that do not exist in nature.



Heterostructure of monolayer WS_2 encapsulated by hBN.

In this project, you will develop a new transfer method to fabricate various high-quality heterostructures and study the excitonic properties of such artificial crystals. Specifically, you will combine materials that host inter-layer excitons, *i.e.*, with the electron in one layer and the hole in other. These inter-layer excitons have long lifetimes and provide new ways to steer light on the atomic scale. You will use photoluminescence spectroscopy and time-resolved emission experiments to study the exciton dynamics, and design nanoscale electrical devices to actively manipulate the light-matter interactions in these novel heterostructures.