The large family of two-dimensional Van der Waals (VdW) materials includes semimetals, semiconductors, superconductors, and insulators such as graphene, monolayer molybdenum disulfide (MoS_2), niobium diselenide ($NbSe_2$) and boron nitride (BN). This class of ***nanomaterials*** is highly researched in the past 2 decades due to the high potential in flexible electronic and opto-electronic devices. Due to the weak VdW forces between adjacent layers in these materials, they can be processed in many ways (mechanical exfoliation, liquid exfoliation, and chemical-vapor-deposition) down to the monolayer regime. Two main features of these materials to mechanical strain are particularly interesting. First, 2D materials sustain very large strains, >20% for graphene, >15% for MoS_2, without breaking. 2D materials possess a relatively high Young's (stretching) modulus, making them appealing for next generation flexible sensors, devices, and electronics. Second, the research interest in 2D materials started to expand to heterostructures consisted of either 2 or more different materials, or the same material but stacked with a specific angle between the crystal unit of the material. The most extensively researched device from the latter heterostructure is magic-angle-twisted-bilayer-graphene (MATBG) which revealed a new type of superconductors.

My lab is investigating the elastic properties of 2D materials and their heterostructures using different experimental methods while varying the temperature. In addition, we exploit the flexibility of the 2D materials to create new devices such as flexible gas sensors, and highly controlled single photon emitters.