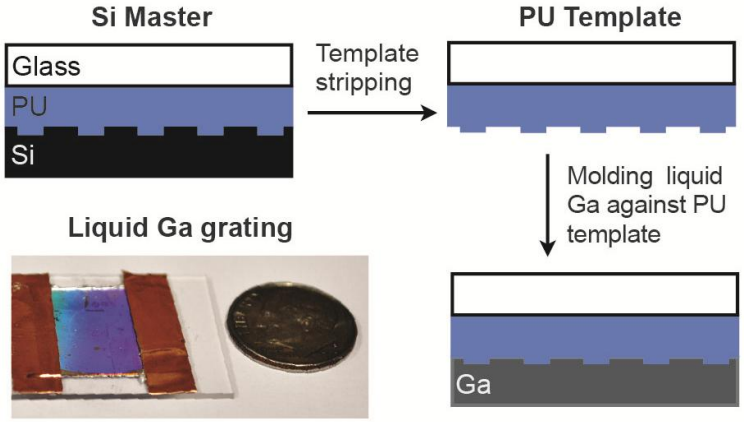
Dynamic Trapping of Light with Tunable Liquid Metal Lattices

Teri W. Odom, Department of Chemistry

NORTHWESTERN UNIVERSITY

We are designing a new class of materials—**liquid metal metamaterials**—whose optical properties can be dynamically tuned to trap light at wavelengths from the ultra-violet to near-infrared. Because of their ability to absorb light strongly and to trap light as surface plasmons, these metamaterials provide unique opportunities to store and convert energy at the nanoscale.



Combining **new nanofabrication methods**, we produced 1D liquid gallium (Ga) gratings, controlled the switching rates between liquid and solid phase transitions, and achieved high on/off contrast ratios of the surface plasmon polariton (SPP) resonances.

The two states of matter exhibited very different optical responses, where the liquid exhibited a higher SPP coupling efficiency and a **narrower SPP resonance**. During the liquid-to-solid phase transition, the freezing point decreased as the initial hold temperature of the liquid increased. Supercooling allowed for access to plasmonic properties of the liquid Ga at temperatures well below (>30°C) the bulk melting point.