Center for Fluid Mechanics, Division of Applied Mathematics
Fluids and Thermal Systems, School of Engineering
Joint Seminar Series

TUESDAY – OCTOBER 22, 2013
3:00pm
Barus & Holley, Room 190

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To Jump or Not to Jump?

Metal nanoparticels placed on solid substrates and melted by nanosecond laser beams may spontaneously jump from the substrate, thanks to the high surface tension of molten metals. The processes that lead to jumping are of direct relevance to self- and directed-assembly of metal nanoparticles which find their applications in a diverse set of fields, such as opto/nanoelectronics, solar panels, and semiconductors, to name just a few. We utilize the state-of-the-art direct simulations based on continuum fluid mechanics to explain the mechanism of ejection. In particular, we show that the jumping is powered by the conversion of the surface energy of the metal, while in liquid phase, to the kinetic energy. It turns out that inertial effects combined with large contact angles of liquid metals on silicon substrates are responsible for the ejection. Numerical simulations also show that the direction of jumping can be controlled by the initial metal geometry: the interplay between the geometry and dynamics determines the direction of ejection. The next challenge is to confirm these findings experimentally.