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## Shock compression dynamics under a microscope

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We have developed a tabletop laser flyer launch system[1] that solves many of the problems that plagued previous efforts. Using a novel mechanism where a spatially-uniform laser pulse creates a shock in a glass substrate just underneath a metal foil, we can launch tiny (0.7 mm diameter x 100 $\mu$m thick) flyers at speeds ranging from 0-5 km/s and the foils are flat, cold and intact. This tabletop launch system, where we often launch 100 flyers per day, provides a platform for a wide variety of time-resolved spectroscopies. The shocked material is viewed by a microscope objective that transmits near-infrared light from a photon Doppler velocimeter to monitor the flyer, and collects the light for spectroscopic and video images. Fluorescent probes, which have been highly developed for the biomedical sciences, have proven especially useful for these experiments. Using emission measurements, we have investigated the fundamental mechanisms of many shock wave effects including: viscoelastic compression of high molecular weight polymers, visualization of shocks in porous media such as sand, where we can observe the behavior of individual grains of sand, shock attenuation by passing the shock through reactive materials that undergo endothermic chemical reactions, and shock initiation of nanoenergetic materials. (1) Curtis, A. D.; Banishev, A. A.; Shaw, W. L.; Dlott, D. D., Laser-Driven Flyer Plates for Shock Compression Science: Launch and Target Impact Probed by Photon Doppler Velocimetry, *Rev. Sci. Instrum.* **2014**, *85*, 043908.