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Introducing New Experiments to the Contemporary Physics Lab: Emphasis on Quantum Mechanics Foundations and New Physics Frontiers KHALID EID, JAN YARRISON-RICE, HERBERT JAEGER, Miami University — We remodeled our sophomore curriculum extensively both in the laboratories and the lectures. Our Experimental Contemporary Physics laboratory (PHY293) was almost completely re-built both in curriculum and pedagogy. Among the new experiments that we introduced are Nanoparticle plasmon resonance, Saturated absorption and fluorescence in iodine molecules, Quantized conductance in atomic-scale constrictions, and Water droplets behavior and manipulation on metal surfaces. This presentation will focus on the last two experiments. Quantized conductance in a constriction in a gold wire being pulled slowly is a unique direct application of the one-dimensional potential wells. Unlike most experiments on quantum mechanics that use optics, this experiment is transport-based, conceptually simple, and robust in addition to being low-cost. The transport properties of the wire span multiple transport regimes while being pulled. It is quite valuable for students (a significant fraction of whom are biological physics and engineering physics majors) to understand the behavior of water droplets on different surfaces. Water is the medium in which biological activities occur and is important in many other applications like air conditioning and refrigeration. We design simple gradients in the hydrophobic/hydrophilic properties of metal surfaces in order to move water droplets in a controlled way, even against gravity. Students explore the effects of surface tension and metal roughness on droplets.

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