Abstract Submitted
for the DFD14 Meeting of
The American Physical Society

New experimental opportunities using refraction matched hydrogel: invisible objects, arrays, and features that obstruct flow but not light JOEL WEITZMAN, LIANNA SAMUEL, ANNA CRAIG, ROBERT ZELLER, STEPHEN MONISMITH, JEFFREY KOSEFF, Stanford University — Water flow in and around immersed bodies, roughness arrays, and major bathymetric features is characterized by a large amount of spatial complexity. In both natural and designed settings, the associated hydrodynamic intricacies have influence on energy dissipation, thermal transfer, and mass exchange. However, the same surfaces that disrupt and redirect fluid motion also greatly restrict observation and measurement options. Solid boundaries tend to limit instrument access and block optical lines of sight. This presentation introduces a new technique expressly designed to overcome these hurdles. High-complexity solid models have been manufactured using a unique super-absorbent copolymer hydrogel. This material is wholly transparent, with an index of refraction nearly identical to that of water. When hydrogel object are submerged, light passes through them just as it passes through the fluid itself. Consequently, these objects and all their features become indistinguishable from their surroundings - effectively invisible. This opens up the entire internal flow field to direct observation and high-resolution quantitative measurement, a feat accomplished without reliance on unconventional fluids or specialized flow facilities.

Joel Weitzman
Stanford University

Date submitted: 01 Aug 2014 Electronic form version 1.4