Abstract Submitted
for the DFD15 Meeting of
The American Physical Society

Wetting and phase separation in soft adhesion KATHARINE JENSEN, ERIC DUFRESNE, Yale University — In the classic theories of solid adhesion, surface energies drive deformation to increase contact area while bulk elasticity opposes it. However, recently solid surface tension has also been shown to play an important role in resisting deformation in soft materials. We explore the consequences for the physics of adhesive contact by performing experiments bringing small, rigid spheres into contact with compliant silicone gel substrates. We measure the quasi-static deformation of the substrate, particularly focusing on its structure near the contact line. In order to satisfy the wetting condition prescribed by surface tension balance while avoiding an elastic singularity at the contact line, we find that the gels undergo an adhesion-induced phase separation. This creates a four-phase contact zone with two additional, hidden contact lines. Our results indicate that accurate theories of adhesion of soft gels need to account both for the compressibility of the gel elastic network and for a non-zero surface stress between the gel and its solvent.

Katharine Jensen
Yale University

Date submitted: 01 Aug 2015 Electronic form version 1.4