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The effect of curvature on the undulation spectrum of Red Blood Cell membranes TATIANA KURIABOVA, University of Colorado, Boulder, MARK L. HENLE, Harvard University, ALEX J. LEVINE, University of California, Los Angeles — The human red blood cell (RBC) membrane has a composite structure of a fluid lipid bilayer tethered to an elastic 2D spectrin network. The study of the mechanical properties of RBCs is crucial to our understanding of their ability withstand large amplitude deformations during their passage through the microvasculature. The linear mechanical response of this composite membrane can be measured by observing its undulatory dynamics in thermal equilibrium, i.e. microrheology. Previous models of these dynamics postulated an effective surface tension. In this talk, we show that surface tension is not necessary. Rather, the coupling of membrane bending to spectrin network compression by curvature can account for the observed dynamics. We use a simplified theoretical model to describe the undulatory dynamics of RBCs, measured experimentally by the Popescu group.[1] Analyzing their data using our model, we observe dramatic changes in RBC membrane elasticity associated with cells' morphological transition from discocytes to echinocyte to spherocyte.

[1]G. Popescu et al. "Imaging red blood cell dynamics by quantitative phase microscopy, Blood Cells, Molecules, and Diseases, (2008), in print"

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