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Suppression of fluid membrane fluctuations by a periodic pinning potential: Applications to red blood cells. MARK L. HENLE, School of Engineering and Applied Sciences, Harvard University, ALEX J. LEVINE, Department of Chemistry and Biochemistry, University of California, Los Angeles — The membrane of the red blood cell (RBC) is tethered to a two- dimensional triangular network of semi-flexible elastic spectrin filaments. This network allows the cell to maintain its structural integrity during the large shape deformations that occur as it circulates through the microvasculature. The lipid membrane is anchored to the spectrin filaments at the nodes of the network. Consequently, these attachments impose a two-dimensional periodic pinning potential upon the membrane. In this talk, we investigate the effect of this pinning potential on the thermal bending fluctuations of the membrane. We show that there is an exact mapping of this system onto the classic problem of non-interacting electrons subject to a periodic potential; we exploit this mapping to obtain an exact analytic solution for a defect-free triangular array of harmonic pinning sites. The pinning potential affects both the local and global structure of the bending fluctuations. To investigate the local structure we consider the bending correlations between two nearby points in the membrane, while for the global structure we consider the total area stored in the fluctuations. We also investigate the effective area modulus of the membrane/spectrin composite structure.

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