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Columnar and crystalline monolayers on curved substrates[1]

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We study thin self-assembled columns constrained to lie on a curved, rigid substrate. The curvature presents no *local* obstruction to equally spaced columns in contrast to curved crystals for which the crystalline bonds are frustrated. Instead, the vanishing compressional strain of the columns implies that their normals lie on geodesics which converge (diverge) in regions of positive (negative) Gaussian curvature, in analogy to the focussing of light rays by a lens. The bending of the layers generates a pre-stress of geometric frustration in the ground state that exists prior to the inclusion of defects. This simple observation is the basis for a versatile analytical approach to calculate the geometrical forces between dislocations and Gaussian curvature in columnar as well as in crystalline monolayers. The resulting forces play an important role in stress relaxation dynamics, elastic instabilities, and melting.

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