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A universal law of the elasticity of multilamellar lipid membranes under compression YVES DUBIEF, LEONIE COWLEY, School of Engineering, University of Vermont, Burlington VT — Multilamellar lipid membranes play critical roles in the mechanics and chemistry of cells, lung and biolubrication of articular joints. One of their most interesting mechanical properties is their elasticity than enable them to resist anisotropic compression where the pressure in the direction normal to the membrane is larger than in other directions. This resistance to compression is strongly dependent on hydration, or the number of water molecules confined between two adjacent lipid membranes. Using coarse-grained molecular dynamics, we show that the elastic behavior or multilamellar membranes is in fact universal over a large range of hydration. A universal law is derived from considerations of intermolecular forces and volume vacancy between lipid molecules. The ability of the proposed law to predict the increase of the membrane surface area as a function of the compression rate and hydration is expected to help the modeling of multilamellar membranes at the continuum level.

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