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Mechanical Properties of Viral Capsids ROYA ZANDI, UCLA, DAVID REGUERA, University of Barcelona — Viral genomes, whether they involve RNA or DNA molecules, are invariably protected by a rigid, single-protein-thick, shell referred to as "capsid." Viral capsids are known to tolerate wide ranges of pH and salt conditions and to withstand internal pressures as high as 100 atms. We study the mechanical properties of viral capsids, calling explicit attention to the inhomogeneity of the shells that is inherent in their being discrete/polyhedral rather than continuous/spherical. We analyze the distribution of stress in these capsids due to isotropic internal pressure (arising, for instance, from genome confinement and/or osmotic activity), and compare the results with appropriate generalizations of classical elasticity theory. We also examine the competing mechanisms for viral shell failure, e.g., in-plane crack formation vs radial bursting. The biological consequences of the special stabilities and stress distributions of viral capsids are also discussed.

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