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Diversity of in-vivo assembled HIV-1 capsids SE IL LEE, TOAN NGUYEN, Physics, Georgia Institute of Technology — Understanding the capsid assembly process of Human Immunodeficiency Virus (HIV), the causative agent of Acute Immuno Deficiency Syndrom (AIDS), is very important because of recent intense interest in capsid-oriented viral therapy. The unique conical shapes of mature HIV-1 capsid have drawn significant interests in the biological community and started to attract attention from the physics community. Previous studies showed that in a free assembly process, the HIV-1 conical shape is not thermodynamically stable. However, if the volume of the capsid is constrained during assembly and the capsid protein shell has high spontaneous curvature, the conical shape is stable. In this work, we focus on in-vivo HIV-1 capsid assembly. For this case, the viral envelope membrane present during assembly imposes constraint on the length of the capsid. We use an elastic continuum shell theory to approximate the energies of various HIV-1 capsid shapes (spherical, cylindrical and conical). We show that for certain range of viral membrane diameter, the conical and cylindrical shapes are both thermodynamically stable. This result is supported by experimental observation that in-vivo assembled HIV-1 capsids are very heterogeneous in shapes and sizes. Numerical calculation is also performed to improve theoretical approximation.

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