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Non-equilibrium process of virus shell assembly ARTEM LEVANDOVSKY, ROYA ZANDI, University of California, Riverside — We study non-equilibrium process of a virus outer shell (capsid) formation as a process of self-assembly from identical protein subunits. We model shell growth by attachment of identical subunits resembling triangular prisms with subsequent relaxation of elastic energy. We elucidate the multitude of generic shapes pertinent to larger viruses. Our model predicts formation of not only the basic virus structures such as sphere or cylinder, but also much less explored irregular shapes of retroviruses, such as HIV. The conspicuous conic motif of HIV viruses is shown to appear as realization of one of the two intermediary substates arising as a destruction of symmetry in sphere-to-cylinder transition. The other substate characterized by highly irregular structures is also observed in this work and is consistent with recently reported experimental observations. We construct unified one-dimensional phase diagram that puts spherical, irregular, conical and cylindrical forms in a rather simple perspective of shapes governed by the spontaneous curvature of protein subunits.

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