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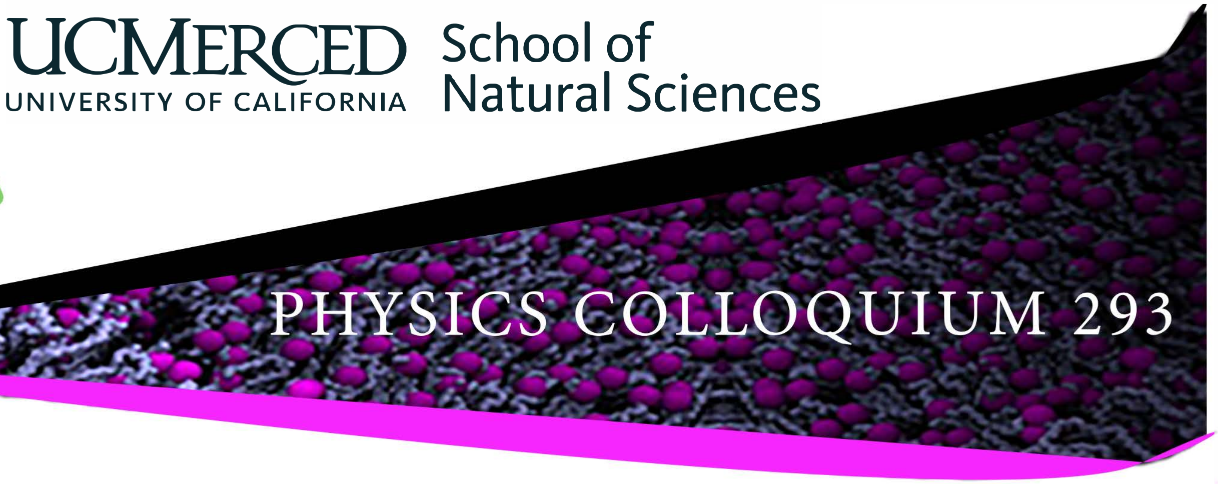

The Self-Assembly of Virus Particles: from Small Spherical Nanoshells to Conical HIV Structures

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ABSTRACT

Viruses infect all kinds of hosts (bacteria, plants, and animals), with all degrees of severity (from the common cold to AIDS). Most of these viruses involve a spherical shell (capsid) that protects their genome. Despite the tremendous diversity in the protein building blocks of these capsids, the structures they adopt almost always have icosahedral symmetry. Many studies have shown that symmetric shells appear in nature as a result of the free energy minimization of a generic interaction between their constituent subunits. Here, I present the physical basis for the formation of symmetric shells, and using a minimal model, demonstrate that these structures can readily grow from the irreversible addition of identical subunits. I will also show that the continuum theory of elastic shells combined with the nonequilibrium assembly process is able to predict the formation of structures pertinent to retroviruses (such as HIV). Our minimal model of assembly yields a unified one-dimensional phase diagram in which the appearance of spherical, irregular, conical and cylindrical structures of retroviruses are seen to be governed by the spontaneous curvature of protein subunits.

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BIO:

Roya Zandi received her PhD at UCLA in 2001. She was a recipient of the UC President's Postdoctoral Fellowship and joined the Department of Physics and Astronomy at the University of CA, Riverside in 2005. Zandi's research has been continuously supported by grants through the National Science Foundation. In 2007, she received the NSF Career Award.

Dr. Zandi's research lies in the fields of statistical mechanics and condensed matter physics. A principal area of current research is the statistical mechanics of virus assembly, both equilibrium and nonequilibrium aspects. She is particularly interested in the influences of electrostatic and entropic mechanisms on the stability of viral structure and on the dynamics of the self-assembly process. Other current projects include the statistical mechanics of both neutral and charged polymers, RNA topology, the dynamics of the passage of polymers through membrane pores, knot theory and Casimir forces in various systems.