Abstract Submitted
for the MAR09 Meeting of
The American Physical Society

Kinetics of human immunodeficiency virus budding and assembly
RUI ZHANG, School of Phyiscs, Georgia Institute of Technology, TOAN NGUYEN, School of Physics, Georgia Institute of Technology — Human immunodeficiency virus (HIV) belongs to a large family of RNA viruses, retroviruses. Unlike budding of regular enveloped viruses, retroviruses bud *concurrently* with the assembly of retroviral capsids on the cell membrane. The kinetics of HIV (and other retroviruses) budding and assembly is therefore strongly affected by the elastic energy of the membrane and fundamentally different from regular viruses. The main result of this work shows that the kinetics is tunable from a fast budding process to a slow and effectively trapped partial budding process, by varying the attractive energy of retroviral proteins (call Gags), relative to the membrane elastic energy. When the Gag-Gag attraction is relatively high, the membrane elastic energy provides a kinetic barrier for the two pieces of the partial capsids to merge. This energy barrier determines the slowest step in the kinetics and the budding time. In the opposite limit, the membrane elastic energy provides not only a kinetic energy barrier, but a free energy barrier. The budding and assembly is effectively trapped at local free energy minimum, corresponding to a partially budded state. The time scale to escape from this metastable state is exponentially large. In both cases, our result fit with experimental measurements pretty well.

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Date submitted: 21 Nov 2008 Electronic form version 1.4