Abstract Submitted
for the MAR09 Meeting of
The American Physical Society

Phase Transition with Non-Thermodynamic States in Reversible Polymerization ELI BEN-NAIM, Los Alamos National Laboratory, PAUL KRAPIVSKY, Boston University — We investigate a reversible polymerization process in which individual polymers aggregate and fragment at a rate proportional to their molecular weight. We find a nonequilibrium phase transition despite the fact that the dynamics are perfectly reversible. When the strength of the fragmentation process exceeds a critical threshold, the system reaches a thermodynamic steady state where the total number of polymers is proportional to the system size. The polymer length distribution has a sharp exponential tail in this case. When the strength of the fragmentation process falls below the critical threshold, the steady state becomes non-thermodynamic as the total number of polymers grows sub-linearly with the system size. Moreover, the length distribution has an algebraic tail and the characteristic exponent varies continuously with the fragmentation rate.

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Date submitted: 26 Nov 2008 Electronic form version 1.4