Abstract Submitted
for the MAR17 Meeting of
The American Physical Society

String-like Collective Motion in the α- and β- Relaxation of a Coarse-Grained Polymer Melt. JACK DOUGLAS, BEATRIZ BETANCOURT, Materials Science and Engineering Division, National Institute of Standards and Technology, Gaithersburg, MD 20899, FRANCIS STARR, Department of Physics, Wesleyan University, Middletown, CT 06459 — The relaxation of glass-forming liquids occurs as a two-stage process- a β-relaxation process having a relaxation time τ_β on the order of *ps,* followed by an α-relaxation process having a relaxation time τ_α that ranges from *ps* to *min* as the fluid is cooled towards its glass transition temperature. Of course, the dramatic change of τ_α with temperature garners the most attention because the impressive changes in τ_α and direct relevance of these changes to applications of glassy materials, but there has also been much interest in β-relaxation observed in neutron and other high frequency measurement methods. We investigate a model glass-forming polymer melt and establish that collective motion has a large influence on relaxation in both the β- and α-relaxation regimes where in both regimes the collective motion takes the form string-like exchange motion of the polymer segments. The temperature dependence of the average string length is *inverted* in the β- and α-relaxation regimes where we see a progressive suppression of collective motion upon cooling in the β-relaxation regime leads to a corresponding increase in the scale of collective motion in the α relaxation regime. We are able to model the string formation in both regimes in terms of equilibrium polymerization models.

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Date submitted: 20 Nov 2016 Electronic form version 1.4