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Translation-rotation decoupling and nonexponentiality in room temperature ionic liquids PHILIP GRIFFIN, Dept. of Physics, University of Tennessee, ALEXANDER AGAPOV, Dept. of Chemistry, University of Tennessee, ALEXEI SOKOLOV, Dept. of Chemistry, University of Tennessee, and ORNL — It is generally accepted that room temperature ionic liquids (RTILs) have many characteristics in common with prototypical molecular glass formers. In order to understand the glassy dynamics of RTILs, we have measured the temperature dependence of structural relaxation time and self diffusion in three imidazolium based RTILs. We demonstrate that self diffusion decouples from structural relaxation in these systems as the temperature is decreased toward T_g , but the degree of decoupling is shown to be exceptionally small. In addition to the weak decoupling, we demonstrate that the temperature dependence of structural relaxation time in all three liquids can be well described by a single Vogel-Fulcher-Tammann (VFT) function over 13 decades in time. Furthermore, the stretching of the structural relaxation is shown to be temperature independent over the same range of timescales, i.e. time-temperature superposition is valid for these ionic liquids in the entire temperature range. These properties are at odds with the usual behavior of most “fragile” glass forming liquids. We suggest that these differences may result from strong and directional intermolecular interactions characteristic to RTILs.

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