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Effective Medium Theory of the Translation-Rotation Paradox for Probe Diffusion in Glass GRIGORI MEDVEDEV, Purdue University, JAMES CARUTHERS — Whereas classic Stokes-Einstein and Debye (SED) theories state that the ratio of translational and rotational diffusion coefficients for a particle in a viscous fluid is a constant, studies of the probe diffusion in supercooled liquids have shown that these diffusion coefficients have essentially different temperature dependencies. The dynamic heterogeneity of the medium near glass transition has been postulated to be the source of the apparent violation of the SED prediction in the numerical simulation by Ediger and co-workers; however these authors did not deal with the rotational diffusion explicitly, estimating it as a simple average over all spatial locations. We expand the Zwanzig theory of diffusion in a dynamically disordered medium to include both translational and rotational diffusion. Our main result is that there exists a range of fractions of "fast" domains in which the translational diffusion is already above its percolation threshold, and thus enhanced, whereas the rotational diffusion is still below its percolation threshold, and thus controlled by the "slow" domains.

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