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From Random Walk to Single File Diffusion[1] BINHUA LIN, MATI MERON, BIANXIAO CUI, STUART A. RICE, University of Chicago, HAIM DIAMANT, Tel Aviv University — We report an experimental study of diffusion in a quasi-one- dimensional weakly interacting colloid suspension. The time range studied encompasses regions that are both shorter and longer than the time between collisions in the system. The mean squared displacement as a function of time is described well with an empirical expression for the entire time range measured. In the empirical expression the inverse mean squared displacement is represented as the sum of the inverse mean squared displacement for short time normal diffusion (random walk) and the inverse mean squared displacement for asymptotic single-file diffusion ($\frac{1}{<x^2(t)>} = \frac{1}{2D_o t} + \frac{1}{2Ft^{1/2}}$). The dependence of the one-dimensional mobility, F, on the concentration of the colloids agrees quantitatively with that predicted for single-file diffusion derived in a Tonks gas, which confirms for the first time the validity of the single-file diffusion theory proposed four decades ago.

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