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**Short-time dynamics of a Brownian particle** BRANIMIR LUKIC, Ecole Polytechnique Federale de Lausanne (EPFL), Switzerland, SYLVIA JENEY, ZELJKO SVIBEN, EPFL Lausanne, CHRISTIAN TISCHER, EMBL Heidelberg, Germany, ERNST-LUDWIG FLORIN, Center for Nonlinear Dynamics, University of Texas, Austin, ANDRZEJ J. KULIK, LASZLO FORRO, EPFL Lausanne — We record the thermal position fluctuations of a *single* micron- sized sphere immersed in a fluid by optical trapping interferometry with nanometer spatial and microsecond temporal resolution. On the shortest time scales investigated, the sphere's inertia has a small, but measurable, effect. We find, in accord with the theory of Brownian motion including hydrodynamic memory effects, that the transition from ballistic to diffusive motion is delayed to significantly longer times than predicted by the standard Langevin equation. This delay is a consequence of the inertia of the fluid. When the particle is confined by a harmonic potential with a depth on the order of $k_BT$, we find that these inertial effects determine the particle's motion at the similar time scale as the potential. Surprisingly, we don't observe the free diffusive behavior in such confined system.

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