Abstract Submitted for the MAR05 Meeting of The American Physical Society

quantum description of Einstein's Brownian motion The FRANCESCO PETRUCCIONE, School of Pure and Applied Physics, University of KwaZulu-Natal, Durban 4041, South Africa, BASSANO VACCHINI, Dipartimento di Fisica dell'Universita di Milano and INFN, Sezione di Milano, Via Celoria 16, I-20133 Milano, Italy — A fully quantum treatment of Einstein's Brownian motion is described. The microscopic analysis is based on the two key features of Einstein's Brownian motion: the homogeneity of the background medium, reflected into the requirement of translational invariance and the connection between dynamics of the Brownian particle and atomic nature of the medium. The former leads to important restrictions both on the expression for possible interactions and on the structure of the completely positive generator of a quantum-dynamical semigroup, the latter to a formulation of the fluctuation-dissipation theorem in terms of the dynamic structure factor, which is directly related to density fluctuations in the medium and therefore to its atomistic, discrete nature. A comparison with the Caldeira-Leggett model is drawn, especially in view of the requirements of translational invariance, further characterizing general structures of the reduced dynamics arising in the presence of symmetry under translations.

> Francesco Petruccione University of KwaZulu-Natal

Date submitted: 01 Dec 2004

Electronic form version 1.4