**ZMATH 2009a.00478**

**Bringuier, E.**

**From mechanical motion to Brownian motion, thermodynamics and particle transport theory.**

Eur. J. Phys. 29, No. 6, 1243-1262 (2008).

Summary: The motion of a particle in a medium is dealt with either as a problem of mechanics or as a transport process in non-equilibrium statistical physics. The two kinds of approach are often unrelated as they are taught in different textbooks. The aim of this paper is to highlight the link between the mechanical and statistical treatments of particle motion in a medium, starting from the well-studied case of Brownian motion. First, deterministic dynamics is supplemented with stochastic elements accounting for the thermal agitation of the host medium: it is the approach of Langevin, which has been rephrased and extended by Kramers. It handles time-independent and time-dependent stochastic motions as well. In that approach, the host medium is not affected by the guest particles and the latter do not interact with each other. Both limitations are shown to be overcome in thermodynamics, which however is restricted to equilibrium situations, i.e. stochastic motions with no net current. When equilibrium is slightly perturbed, we show how thermodynamic and kinetic concepts supersede mechanical concepts to describe particle transport. The description includes multicomponent transport. The discussions of stochastic dynamics and of thermodynamics are led at the undergraduate level; the treatment of multicomponent transport introduces graduate-level concepts.

*Classification:* M65
*Keywords:* link between the mechanical and statistical treatments of particle motion in a medium
doi:10.1088/0143-0807/29/6/013