

Ph.D. RESEARCH (THEORY) [1,2]:

My adviser and I were studying a randomly accelerated particle moving on a line between two boundaries. We considered two types of boundaries:

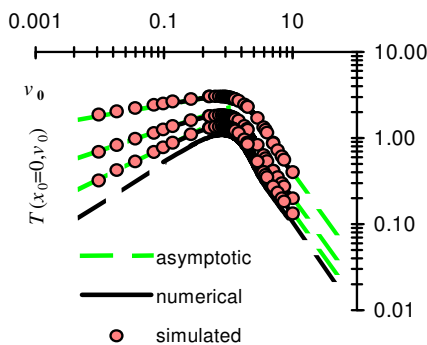
a) inelastic: velocities v_f (just after) and v_i (just before the collision) were related by $v_f = -rv_i$. Cornell, Swift, and Bray [3] have argued that for $r < r_c = \exp(-\frac{\pi}{\sqrt{3}}) = 0.163\dots$ the particle undergoes inelastic collapse, coming to rest at one of the boundaries after an infinite sequence of collisions in a finite time.

b) partial survival: particle was absorbed with probability $1-p$ or reflected elastically with probability p .

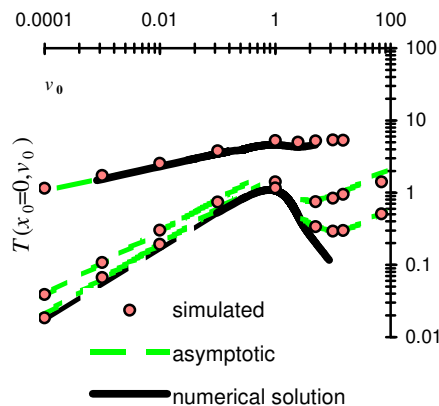
We were calculating the mean lifetime $T(x_0, v_0)$ for the particle between the boundaries as a function of initial velocity v_0 , and position x_0 . This quantity satisfies an inhomogeneous Fokker - Planck differential equation with specific boundary conditions, different for each case:

$$(v_0 \frac{\partial}{\partial x_0} + \frac{\partial^2}{\partial v_0^2})T(x_0, v_0) = -1 \quad T(0, -v_0) = pT(0, v_0), v_0 > 0 \quad \text{or} \quad T(0, -v_0) = T(0, rv_0), v_0 > 0$$

Following the approach of Masoliver and Porra [4] we have transformed the differential equation into an integral one and obtained both numerical and exact analytical predictions. The inelastic collapse interpretation of Cornell *et al* [3] has been questioned on the basis of simulations. We have written an accelerated [5,6] program to perform computer simulations and have find excellent agreement with the analytical and numerical results. Our theoretical analysis is providing definitive answers to some of the controversial questions. In [2] we calculated the equilibrium distribution and found the particle is not localized at the boundary, which disagrees with [3].



Partially survival case, mean lifetime for (from bottom to top) $p=0$ (no simulations), $p=0.25$, $p=0.5$, and $p=0.75$.



Inelastic case, mean lifetime for (from bottom to top) $r=0$ (no simulations), $r=0.001$, $r=0.01$, and $r=0.1$. For $r > r_c$ $T(x_0, v_0)$ is infinity.

PAST EXPERIMENTAL RESEARCH EXPERIENCE:

1993-1995 Surface Plasmon resonance [7,8]

We studied layers of latex particles (19nm or above), and ferritin macromolecules (~11nm) sedimented from a suspension on a silver substrate.

SP resonance is an experimental optical method for investigation of the surface of metallic films opposite to the surface irradiated by the laser. We considered a 500 nm Ag layer and a 632.8nm laser. The thickness and refractive index of the thin coating (ferritin or latex) on the non irradiated surface were determined. We also used the method for structural studies of the coating with a resolution of about a micron.

1995-1997 Light scattering from thin layers of nano-size TiO₂ and SiO₂ particles [paper in preparation]

Our layers of TiO₂ (~250nm) and SiO₂ (~130nm) particles were produced by sedimentation from a suspension. They were a few hundreds of nm thick which was compatible to the mean free path of the photon. So, the well-known diffusion approximation did not hold, due to insufficient scattering. We described the system in a simple four-flux approximation, in which the electromagnetic energy is divided into fully ballistic or fully scattered (diffusive) fluxes. We evaluated the phenomenological parameters of the model for the investigated layers on the basis of the performed experiments. Such layers are of interest for the paint industry.

ADDITIONAL EXPERIENCE:

Spring and Summer of 1995 Semifluorinated alkanes in mixtures [9] - Surfactant Science Group, Department of Chemistry, University of Hull, UK

1999–2000 Fractal dimension of computer simulated tumors - in Temple University

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3. S. J. Cornell, M. R. Swift, and A. J. Bray, *Phys. Rev. Lett.* **81**, 1142 (1998).
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