

Physics 219
Homework 9

The following problem gives you some practice solving stochastic equations. You should read Reif sections 15.5 to 15.10 for more detail on how to solve an important example of such equations: The Langevin equation.

1. A particle in a vacuum experiences no damping but is subject to a random electromagnetic force. This leads to the equation

$$\frac{d\mathbf{p}}{dt} = \mathbf{f}(t)$$

where $\mathbf{f}(t)$ is a random variable with correlation function

$$\langle \mathbf{f}(t) \cdot \mathbf{f}(t') \rangle = C\delta(t - t')$$

and C is a constant.

The particle starts at rest with zero velocity. Calculate $\langle (\mathbf{r}(t) - \mathbf{r}(0))^2 \rangle$ and $\langle p^2(t) \rangle$.

Optional: Sethna problem 2.7.