Brownian motion with coordinate dependent diffusivity and damping

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I will be talking on Brownian motion in a space which has coordinate dependent damping and diffusivity. There is a lot of controversy related to such stochastic systems arising from the dilemma of Itô vs Stratonovich convention and many other variants of Stratonovich convention. However, the agreed upon fact so far is that the probability distribution in equilibrium of such systems is the Boltzmann distribution. The intriguing fact about such systems is that there is inhomogeneity of space which is not captured by the Hamiltonian. The Boltzmann distribution, as a result, can not reflect this inhomogeneity of space. I will show that, using standard Kramers-Moyal expansion, the general equilibrium probability distribution for such a system under confinement comes out to be a modified Boltzmann distribution involving coordinate dependent diffusivity and it makes sense to use that [1-2]. This generalization of equilibrium distribution can actually have far reaching consequences as it would modify the Stokes-Einstein relation and as a consequence would show that the coordinate dependent temperature is ruled out in such systems which is an essential requirement for equilibrium.

References:

[1] A. Bhattacharyay, Physica A 515 (2019) 665670.

[2] A. Bhattacharyay, arXiv:1901.08358v2