Abstract Submitted
for the OSS09 Meeting of
The American Physical Society

The Derivation of the Equation of the Damped Harmonic Oscillator from Lagrangian Methods with a Kaluza-Klein-like Hidden Dimension

JOHN BRANDENBURG, Orbital Technologies Corporation — Lagrangian methods cannot include non-conservative forces and therefore cannot produce a simple derivation of the ubiquitous and very useful damped harmonic oscillator equation. Recently, it has been found that the damping term can be included in a Lagrangian approach by employing a Kaluza-Klein hidden dimension (Klein 1926). In this application of the method, the hidden variable occurs as a "subscale model" where the normal Lagrangian for a harmonic oscillator is written .5(mq'^{2} -kq^2 + 2sq'q* +m*q$_o$'^{2}) where q* is an integral over a short cyclic collision time of subscale molecular model coordinate derivative q$_o$' where a molecular coordinate shares velocity with a mass m as it collides and "sticks" to it, so that q$_o$'=q' during the interval of integration, and finally m* is a very small "molecular" mass. This results in the total derivative acquiring the term sq' and the resulting equations mq" +sq' +kq =0 and m*q$_o$'=Constant being recovered. This exercise gives insight to the use of Kaluza-Klein hidden dimension in Gravitational physics and also suggests such hidden dimensions can add a "thermal bath" to otherwise conservative problems. Klein O. (1926) "Quantum Theory and Five-Dimensional Relativity Zeitschrift fur Physik" **37**, 895.

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Date submitted: 06 Apr 2009 Electronic form version 1.4