

Texas Tech University. Joint Analysis and Applied Math Seminars.

# Noisy rolling ball: non-holonomic constraints perturbed by the noise, conservation of integrals of motion and rolling friction

VAKHTANG PUTKARADZE

*University of Alberta*

**Monday, September 11, 2017**  
**Room: MATH 112. Time: 4:00pm.**

**ABSTRACT.** We will discuss some examples of mechanical systems with non-holonomic constraints are modified by the presence of noise. The modification introduces an interesting type of stochasticity in the equations of motion, which will be illustrated on the example of a Routh (Chaplygin) sphere rolling on a flat surface. This is a classical example of a non-holonomic system possessing three integrals of motion, namely the energy, Jellet and Routh. We will show that depending on the type of noise introduced in the rolling constraint, one can either preserve either energy only, both energy and Jellet, or only Jellet integrals. We also contrast these results with the dynamics of non-holonomic systems with the drift noise, derive the general theory of motion of non-holonomic systems of the semidirect product type, and discuss general results on energy preservation. We conclude with a discussion of the relevance of this work for rolling friction in dynamics due to random slipping as originally suggested by Reynolds (1876).