

MICHIGAN STATE UNIVERSITY  
Department of Statistics and Probability

## A Workshop on Future Directions in Fractional Calculus Research and Applications

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### Space-Time Fractional Stochastic Partial Differential Equations

#### **Abstract**

Stochastic partial differential equations and random fields have been used as successful models in various areas of applied mathematics, statistical mechanics, theoretical physics, theoretical neuroscience, theory of complex chemical reactions, fluid dynamics, hydrology, cosmology, mathematical finance, and other scientific areas. In this talk I will consider non-linear space-time fractional stochastic heat type equations.

These types of time fractional stochastic heat type equations are attractive models that can be used to model phenomenon with random effects with thermal memory.

I will talk about the asymptotic behavior of the solution with respect to time and a parameter  $\lambda$ . In particular, I will discuss: (i) Existence and uniqueness of solutions and existence of a continuous version of the solution; (ii) absolute moments of the solutions of this equation grows exponentially; and (iii) the distances to the origin of the farthest high peaks of those moments grow exactly linearly with time. Our results are significant extensions of those in recent papers by Foodun, Liu, Omaba (Moment bounds for a class of fractional stochastic heat equations. Preprint. 2014), Mijena and Nane(Space-time fractional stochastic partial differential equations. Stochastic Process. Appl. 125, (2015) 33013326.), Foondun and Khoshnevisan (Intermittence and non-linear parabolic stochastic partial differential equations, Electron. J. Probab. 14 (2009), no. 21, 548{568}), and Conus and Khoshnevisan (On the existence and position of the farthest peaks of a family of stochastic heat and wave equations, Probab. Theory Related Fields 152 (2012), no. 3-4, 681{701})

I will also mention some recent works on the time fractional stochastic heat type equation in the literature. These results are our recent joint work with Jebessa B Mijena, Mohammud Foondun, Sunday Asogwa and Guerngar Ngartelbaye.