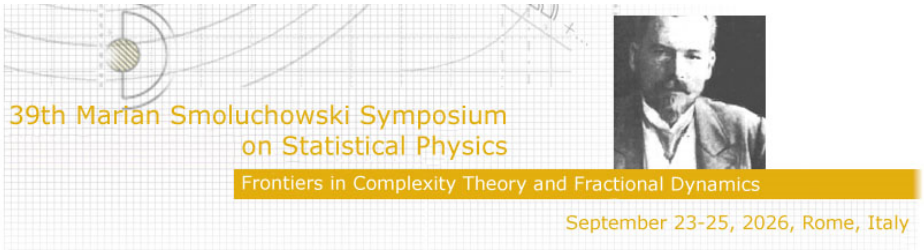

Contribution ID: **1** Type: **Invited talk**

Heavy distribution tails and explosive moments in a doubly-stochastic model of cell proliferation

Thursday, 24 September 2026 11:30 (30 minutes)

This presentation generalizes and expands the theory for a particular branching process (see Kimmel and Axelrod (2015) Branching processes in biology) used to model cancerous tumors. The process was first introduced by us in Ernst et al. (2018) Adv Appl Prob 50A: 99-114. The motivation were data from Perez-Garcia et al. Nat Phys (2020) 16: 1232 who found super-exponential growth examples among published cancer data. Ernst et al. (2018) introduced a branching process model with randomly mutating reproduction rates of this phenomenon, and found that it exhibited heavy tails and first moment explosions in finite time with implications for statistical analysis. In this presentation we expand this study by allowing to include cell death and/or the use of an arbitrary non-negative distribution of mutated reproduction rates (originally exponential only was allowed). We found conditions to exclude first moment explosions. Moreover, for a well-defined class of "light-tailed" distributions, the same is true, with no restriction on death or mutation rates. One interesting observation is that under the fist-moment explosion regime, the canonical classification of the branching processes into sub-critical, critical and supercritical has to be modified. Since transitions of the parameters of the cell cycle distributions are quite common, and not only in cancer cells, the process we are developing may be of interest to biologists.

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