ATHENS *Pr*OBABILITY COLLOQUIUM

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"**Entrance and exit at infinity for stable jump diffusions**"

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Abstract:

In his seminal work from the 1950s, William Feller classified all one-dimensional diffusions on $-\infty \le a < b \le +\infty$ in terms of their ability to access the boundary (Feller's test for explosions) and to enter the interior from the boundary. Feller's technique is restricted to diffusion processes as the corresponding differential generators allow explicit computations and the use of Hille-Yosida theory. In the present talk we study exit and entrance from infinity for the most natural generalization, that is, jump diffusions of the form

$$dZ_t = \sigma(Z_{t-})\, dX_t,$$

driven by stable Levy processes for $\alpha \epsilon (0,2)$. Many results have been proved for jump diffusions, employing a variety of techniques developed after Feller's work but exit and entrance from infinite boundaries has long remained open. We show that the presence of jumps implies features not seen in the diffusive setting without drift. Finite time explosion is possible for $\alpha \epsilon (0,1)$, whereas entrance from different kinds of infinity is possible for $\alpha \epsilon [1,2)$. We derive necessary and sufficient conditions on σ so that (i) non-exploding solutions exist and (ii) the corresponding transition semigroup extends to an entrance point at "infinity."

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