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On the spread of an infection in a spatially distributed host population with host immunity

The general branching process or Crump-Mode-Jagers (CMJ) process is a fairly general branching process that unifies and extends earlier models of individual-based branching processes. Nerman's celebrated law of large numbers (1981) states that, for a supercritical CMJ process $(\mathcal{Z}_t)_{t\geq 0}$, under some mild assumptions, $e^{-\alpha t}\mathcal{Z}_t$ converges almost surely as $t \to \infty$ to a random variable aW. Here, $\alpha > 0$ is the Malthusian parameter, a is a constant and W is the limit of Nerman's martingale, which is positive on the event that the population survives.

I shall present a recently obtained central limit theorem for the CMJ process that explains how $\mathcal{Z}_t$ fluctuates around its first-order term $e^{\alpha t}aW$.

The talk is based on joint work with Alexander Iksanov (Kyiv) and Konrad Kolesko (Wroclaw).