

Interplay between fast diffusion and Allee effect

Thomas Giletti (Univ. of Lorraine)

Abstract: We will discuss the spreading properties of solutions of monostable equations with nonlinear diffusion (both in the porous medium diffusion and in the fast diffusion regimes). Our equation typically writes as

$$\partial_t u = \partial_{xx}(u^m) + u^\beta(1 - u),$$

which we supplement with a positive initial datum u_0 such that

$$\lim_{x \rightarrow -\infty} u_0(x) > 0 = \lim_{x \rightarrow +\infty} u_0(x).$$

Fast diffusion ($0 < m < 1$) naturally tends to accelerate the spreading of solutions, and in the typical KPP case ($\beta = 1$) this leads to a propagation with infinite speed, regardless of the decay of the initial datum as $x \rightarrow +\infty$. However an Allee effect ($\beta > 1$) tends to slow it down. We study the balance between these two outcomes and aim at a comprehensive view of whether acceleration occurs or not, depending also on the initial datum. In most accelerating cases, we will also show accurate estimates on the position of the level sets.