

# LARGE TIME BEHAVIOR FOR A NONLOCAL DIFFUSION EQUATION IN DOMAINS WITH HOLES

C.CORTÁZAR, M ELGUETA

Departamento de Matemática, Pontificia Universidad Católica de Chile

F. QUIRÓS

Departamento de Matemáticas, Universidad Autónoma de Madrid

and

N. WOLANSKI\*

Departamento de Matemática, FCEN, Universidad de Buenos Aires

In this talk I will present a nonlocal diffusion equation of convolution type with a smooth kernel of compact support. These kind of equations may model dispersal of a species with long range interactions.

We consider this problem in the complement of a bounded domain in  $\mathbb{R}^N$  with zero Dirichlet conditions and address the question of the long time behavior of solutions with finite initial mass.

We find that the behavior strongly depends on dimension. For large dimensions  $N \geq 3$ , solutions decay at the rate  $t^{N/2}$  as is the case for the Cauchy problem (the problem set in the whole  $\mathbb{R}^N$ ). Instead, for small dimensions  $N = 1, 2$  not only is the rate different from the one for the Cauchy problem, but the local decay rate differs from the global one.

In all these situations we find the final profile. To this end we first find the profile at infinity and match it with the local one. This matching is more involved for small dimensions due to the different decay rates. Even more, in dimension 1, the asymptotic radial symmetry at infinity of the final profile that holds for the other dimensions is lost even for small holes. The proof involves the construction of convenient sub- and super-solutions as well as pointwise estimates of the “good” part of the fundamental solution of the operator and its derivatives.