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José Antonio Carrillo is a Professor at the University of Oxford, UK. He served as Chair of the Applied Mathematics Committee of the European Mathematical Society 2014-2017 and was Vice-President of the European Society for Mathematical and Theoretical Biology 2021-2023. He is member of the Scientific Committee of the Spanish National Science Agency 2021-2024.

He has been a recipient of a Wolfson Research Merit Award 2012-17 of the Royal Society and was awarded the Echegaray Medal 2022 by the Royal Spanish Academy of Sciences for his contributions in PDEs and its applications. He received the Richard Von Mises prize of the GAMM and the SEMA prize for young researchers in 2006.

He was elected to the European Academy of Sciences 2018 and Academia Europea 2023, and a SIAM Fellow Class 2019. He is a Foreign Member of the Royal Academy of Sciences of Spain since 2021. Web page: <https://www.maths.ox.ac.uk/people/jose.carrillodelaplata>

Title: Nonlocal Aggregation-Diffusion Equations: fast diffusion and partial concentration

Abstract:

We will discuss several recent results for aggregation-diffusion equations related to partial concentration of the density of particles. Nonlinear diffusions with homogeneous kernels will be reviewed quickly in the case of degenerate diffusions to have a full picture of the problem. Most of the talk will be devoted to discuss the less explored case of fast diffusion with homogeneous kernels with positive powers. We will first concentrate in the case of stationary solutions by looking at minimisers of the associated free energy showing that the minimiser must consist of a regular smooth solution with singularity at the origin plus possibly a partial concentration of the mass at the origin. We will give necessary conditions for this partial mass concentration to and not to happen. We will then look at the related evolution problem and show that for a given confinement potential this concentration happens in infinite time under certain conditions. We will briefly discuss the latest developments when we introduce the aggregation term. This talk is based on a series of works in collaboration with M. Delgado, J. Dolbeault, A. Fernandez, R. Frank, D. Gomez-Castro, F. Hoffmann, M. Lewin, and J. L. Vazquez.