Barcelona Analysis Seminar **2021–2022**

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Room. Room B1, Universitat de Barcelona

Online streaming (Zoom). https://ub-edu.zoom.us/j/95139878362

Optimal regularity for supercritical parabolic obstacle problems

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The nonlocal parabolic obstacle problem for an elliptic operator L with zero obstacle is

$$\begin{cases} \min\{u_t - Lu, u - \varphi\} = 0 & \text{in} \quad \mathbb{R}^n \times (0,T) \\ u = \varphi & \text{at} \quad t = 0. \end{cases}$$

When L is the Laplacian, this problem is closely related to the Stefan problem, that models phase transitions. When L is a nonlocal operator such as the fractional Laplacian $(-\Delta)^s$, the equation serves as a model for stock pricing and other random processes with jumps.

The elliptic (time-stationary) version of this problem has been thoroughly studied since the pioneer works of Caffarelli, Salsa and Silvestre around 2007. However, much less is known about the parabolic problem.

When L is the fractional Laplacian, Caffarelli and Figalli proved in 2013 that the solutions are $C^{1,s}$ in space and $C^{1,\alpha}$ in time. Still in the case of $(-\Delta)^s$, for $s > 1/2$, Barrios, Figalli and Ros-Oton proved that the free boundary is $C^{1,\alpha}$ at regular points.

In this talk, we present our recent results with X. Ros-Oton, where we proved the optimal regularity of the solutions and a global $C^{1,\alpha}$ free boundary regularity for the case $s < 1/2$.