

# The fractional obstacle problem

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**Abstract:** In this talk we present an introduction to integro-differential operators and the obstacle problem, and how they interact with each other in what is known as the *fractional obstacle problem*.

In  $\mathbb{R}^n$ , the fractional obstacle problem with a given obstacle  $\varphi \in C_c^\infty(\mathbb{R}^n)$  can be written as

$$\min\{(-\Delta)^s u, u - \varphi\} = 0 \quad \text{in } \mathbb{R}^n.$$

The set  $\{u = \varphi\}$  is called the *contact set*, and its boundary  $\partial\{u = \varphi\}$  is called the *free boundary*, which are unknowns of the problem. The free boundary can be divided into two sets: regular points (where it is regular) and degenerate points. In general, degenerate points can exist in any dimension.

We will finish the talk by presenting joint results with C. Torres-Latorre on the generic regularity of the free boundary. In particular, in dimension  $n = 3$  we show that the free boundary of almost every solution is formed only of regular points.

## References

- [1] X. Fernández-Real, X. Ros-Oton (2021). Free boundary regularity for almost every solution to the Signorini problem, *Arch. Ration. Mech. Anal.* 240, 419-466.
- [2] X. Fernández-Real, C. Torres-Latorre (2023). Generic regularity of free boundaries for the thin obstacle problem, *Adv. Math.* 433, 109323.