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Finite and infinite speed of propagation for porous medium equations with nonlocal pressure

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Abstract: We consider the following diffusion equation of porous medium type $u_t = \nabla(u^{m-1}\nabla p)$, with nonlocal pressure $p = (-\Delta)^{-s}(u)$, for $m > 1$, $0 < s < 1$ and $u(x, t) \geq 0$. To be specific, the problem is posed for $x \in \mathbb{R}^N$, $N \geq 1$ and $t > 0$. The initial data $u(x, 0)$ is assumed to be a bounded function with compact support or fast decay at infinity. The problem has been recently studied by Caffarelli and Vázquez, also by Biler, Karch and Monneau in the particular case $m = 2$. In a recent collaboration with Felix del Teso and Juan Luis Vázquez we prove how the nonlinearity has a strong influence on the finite propagation property of the solution. More exactly, we prove two different behaviors depending on the exponent m : for $m \geq 2$ the problem has finite speed of propagation, while for $m < 2$ has infinite speed of propagation.

