

## **Nonlocal space-time equations and the master equation**

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We present recent advances in the analysis of equations that are nonlocal both in space and time, like the master equation from continuous time random walks. In particular, we study the fractional powers of the heat operator. Unlike the case of the fractional Laplacian, the Fourier multiplier of the heat equation is complex valued. This creates a difficulty in the definition of the fractional powers that is avoided with a subtle use of complex variables techniques. From this point on the underlying idea to understand these equations is the language of semigroups. In particular, we obtain pointwise formulas, maximum principles, a characterization with a parabolic extension problem, interior and boundary Harnack inequalities as well as Hölder and Schauder estimates. This is joint work with José L. Torrea (Universidad Autónoma de Madrid, Spain).