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Analyticity of Solutions to Fractional Partial Differential Equations

We will explore a classic topic in the realm of partial differential equations (PDEs) within a contemporary context: the analyticity of solutions to elliptic equations. While initial results for classical elliptic PDEs were established by Bernstein in 1904, the landscape for fractional and non-local equations remains less fully charted, with only partial results or findings pertaining to very specific cases, such as the Hartree-Fock and Boltzmann equations, available to date.

In this presentation, we will review some of the established results before delving into our recent discoveries. These include advances in understanding knot energies, general semi-linear integro-differential equations, and two classes of non-linear integro-differential equations. Notably, we will examine the non-local minimal surfaces introduced by Caffarelli, Roquejoffre, and Savin, and discuss how our findings contribute to this evolving field.