

## **On the Bayesian formulation of fractional inverse problems and data-driven discretization of forward maps.**

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The great promise of nonlocal models described by fractional partial differential equations (FPDEs) has been largely confirmed in a variety of applications. A common scenario is that fractional order models are well established, and yet the correct order is hard to determine as it may depend on specific features of the problem. In this talk I will consider theoretical and computational questions arising in the Bayesian inversion of fractional models. On the theoretical side, I will introduce a Bayesian formulation of fractional elliptic inverse problems and show that the Bayesian solution depends continuously on the observed data. From a computational side, the main challenge is the large cost of evaluating an expensive forward map involving an FPDE. This challenge is fundamental to the Bayesian inversion of complex models (not necessarily fractional) since vanilla MCMC sampling methods require repeated evaluation of the forward map. I will propose a new general data-driven framework for efficient discretization of forward maps, where the spatial refinement of the grid is informed by the observed data. This talk is based on joint work with Daniel Sanz-Alonso as well as work with Daniele Bigoni, Youssef Marzouk, and Daniel Sanz-Alonso.