

## Bayesian inverse problems, Gaussian processes, and PDEs

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The Bayesian approach to inverse problems has become very popular in the last decade after seminal work by A. Stuart (2010). Particularly in non-linear applications with PDEs and when using Gaussian process priors, this can leverage powerful MCMC algorithms to tackle difficult high dimensional and nonconvex inference problems, with associated *uncertainty quantification methodology*. We review the main ideas and then discuss recent progress on rigorous mathematical performance guarantees for such algorithms. We will touch upon issues such as how to prove posterior consistency theorems, how to objectively validate posterior based statistical uncertainty quantification, as well as the polynomial time computability of posterior measures in some nonconvex model examples arising with PDEs.