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# Optimization Program Inverse Problems Workshop
# January 26-27, 2017

**Lecture:** ***Computationally Efficient Markov Chain Monte Carlo Methods for Hierarchical Bayesian Inverse Problems***

**Speaker:** Andrew Brown

## Abstract:

In Bayesian inverse problems, the posterior distribution can be used to quantify uncertainty about the reconstructed solution. In practice, approximating the posterior requires Markov chain Monte Carlo (MCMC) algorithms, but these can be computationally expensive. We present a computationally efficient MCMC sampling scheme for ill-posed Bayesian inverse problems. The forward map is assumed to be linear with additive Gaussian noise, and the goal is to reconstruct the solution as well as to estimate regularization parameters. We employ a Metropolis-Hastings-within-Gibbs (MHwG) sampler with a proposal distribution based on a low-rank approximation of the prior-preconditioned Hessian. We show the dependence of the acceptance rate on the number of eigenvalues retained and discuss conditions under which the acceptance rate is high. We demonstrate our proposed sampler through numerical experiments in electroencephalography and computerized tomography.