1172-15-333 **Mirjeta Pasha*** (mpasha3@asu.edu), Arizona State University, Tempe, AZ 85283, and **Julianne Chung**, **Matthias Chung** and **Silvia Gazzola**. *Efficient methods for large-scale optimal variational inversion design.* Preliminary report.

In this talk, we discuss various approaches that use learning from training data to solve inverse problems, following a bi-level learning approach. We consider a general framework for optimal inversion design, where training data can be used to learn optimal regularization parameters, data fidelity terms, and regularizers, thereby resulting in superior variational regularization methods. In particular, we describe methods to learn optimal p and q norms for $L^p - L^q$ regularization and methods to learn optimal parametric regularization matrices. We exploit efficient algorithms based on Krylov projection methods for solving the regularized problems, both at training and validation stages, making these methods well-suited for large-scale problems. We experimentally show that the learned regularization methods perform well even when the data are corrupted by noise coming from different distributions, or when there is some inexactness in the forward operator. (Received August 31, 2021)