1056-68-662 **Zachary T. Harmany**, Duke University, **Roummel F. Marcia*** (rmarcia@ucmerced.edu), University of California, Merced, 5200 North Lake Road, Merced, CA 95343, and **Rebecca M. Willett**, Duke University. *This is SPIR̈AL TAP: Sparse Poisson intensity reconstruction algorithms (theory and practice).*

The observations in many applications consist of counts of discrete events, such as photons hitting a dector, which cannot be effectively modeled using an additive bounded or Gaussian noise model, and instead require a Poisson noise model. As a result, accurate reconstruction of a spatially or temporally distributed phenomenon (f) from Poisson data (y) cannot be accomplished by minimizing a conventional $l_2 - l_1$ objective function. This talk the estimation of f from y in an inverse problem setting, where (a) the number of unknowns may potentially be larger than the number of observations and (b) f admits a sparse approximation in some basis. The optimization formulation we consider uses a negative Poisson log-likelihood objective function with nonnegativity constraints (since Poisson intensities are naturally nonnegative). We describe computational methods for solving the constrained sparse Poisson inverse problem. In particular, we propose an approach that incorporates key ideas of using quadratic separable approximations to the objective function at each iteration and computationally efficient partition-based multiscale estimation methods. (Received September 15, 2009)