# ACMS Statistics Seminar

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**Tuesday, March 5**
**101A Crowley Hall**
**3:30– 4:30 PM**

## Calibration Concordance for Astronomical Instruments via Multiplicative Shrinkage

Calibration data are often obtained by observing several well-understood objects simultaneously with multiple instruments, such as satellites for measuring astronomical sources. Analyzing such data and obtaining proper concordance among the instruments is challenging when the physical source models are not well understood, when there are uncertainties in "known" physical quantities, or when data quality varies in ways that cannot be fully quantified. Furthermore, the number of model parameters increases with both the number of instruments and the number of sources. Thus, concordance of the instruments requires careful modeling of the mean signals, the intrinsic source differences, and measurement errors. We propose a log-Normal model and a more general log-t model that respect the multiplicative nature of the mean signals via a half-variance adjustment, yet permit imperfections in the mean modeling to be absorbed by residual variances. We present analytical solutions in the form of power shrinkage in special cases and develop reliable Markov chain Monte Carlo (MCMC) algorithms for general cases. We apply our method to several datasets including a combination of observations of active galactic nuclei (AGN) and spectral line emission from the supernova remnant E0102, obtained with a variety of X-ray telescopes such as Chandra, XMM-Newton, Suzaku, and Swift. The data are complied by the International Astronomical Consortium for High Energy Calibration (IACHEC). We demonstrate that our method provides helpful and practical guidance for astrophysicists when adjusting for disagreements among instruments.