

SAMSI Astrostatistics Course – Fall 2016

Instructor: James Long, Assistant Professor of Statistics, Texas A&M University.

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Meeting Times: Wednesdays 4:30 pm – 7:00 pm at SAMSI, room 150 from Sept 7 through Nov 30. No class Nov 23.

Office Hours: After class or by appointment.

Course Description: With the advance of digital imaging techniques, astronomy has become a data science in which knowledge creation depends on applying and developing sophisticated statistical methodology to large and/or complex data sets. This course will cover common types of data in astronomy such as light curves, spectra, and images as well as statistical methods used for analyzing these data sets, such as functional data analysis, measurement error models, hierarchical models, survival analysis, and machine learning techniques. An emphasis will be placed on the complexity of the inference tasks faced by astronomers and the propagation of uncertainty across several levels of inference. Guest lecturers will discuss topical issues in the analysis of astronomy data. The course will be aimed at a wide audience in an effort to appeal to students with either an astronomy or statistics background.

Textbook / Reading: No textbook is required. Some useful references

- Feigelson and Babu: Modern Statistical Methods for Astronomy, ISBN 9780521767279.
- Ivezić, Connolly, VanderPlas, and Gray: Statistics, Data Mining, and Machine Learning in Astronomy, ISBN 9780691151687.

Sampling of possible articles for class discussion:

- “A Framework for Statistical Inference in Astrophysics” Ann. Rev. of Stat., Schafer
- “Some Aspects of Measurement Error in Linear Regression of Astronomical Data” ApJ, Kelly
- “Unsupervised Transient Light Curve Analysis via Hierarchical Bayesian Inference” ApJ, Sanders
- “Modeling Light Curves for Improved Classification” Statistical Analysis and Data Mining, Faraway
- “Multilevel Bayesian Framework for Modeling the Production, Propagation and Detection of Ultra-High Energy Cosmic Rays” Annals of Applied Statistics, Soiaporn

Course Project: There will be no homework assignments. Students will complete a course project and present their results orally as part of one of the final two lectures. The topic for the project must be approved by the instructor but could involve reproducing the results of an astrostatistics research article, an algorithm comparison / simulation study, discussion of some astrostatistics topic not covered in class, or results from original research in the area of astrostatistics.