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Introduction to the Special Section on Astrostatistics

At least since Johannes Kepler asked Tyco Brahe to share his unusually precise measurements, astronomers and astrophysicists have been seeking to improve the quantity and quality of their data. Early data sets were small and painstakingly compiled: weeks studying hundreds of photographic plates to identify a handful of galaxies, days at the telescope tracking the brightness of a few variable stars, hours at high altitudes to measure spectra of one object at a time. Statistics played a role, but in the background. The χ^2 test was the standard tool.

Today, the trickle of data has become a flood; astronomers collect more data in a day than previous generations could collect in a lifetime. Astronomical surveys are now measuring properties of *millions* of celestial objects, and the quality of the data has improved at least as much as its quantity. The result is that scientists are looking for ever more complex and subtle effects. The χ^2 test may still be the dominant tool—if only as a historical relic—but there is increasing demand for new statistical techniques.

The stakes are high, with hundreds of millions of dollars being spent on space science research. The conclusions are dramatic, as anyone reading *The New York Times* science section can see. Many of the most striking conclusions about the structure and history of our Universe are based on statistical arguments, yet where are the statisticians? The good news is that some statisticians have become deeply involved in astronomical research. The better news is that many more problems are ripe for solution. The papers in this section give the reader a taste of some ongoing collaborations between astronomers, astrophysicists and statisticians. A name has sprung up around this work: astrostatistics.

Although, historically, the ties between astronomy and statistics were strong, since Neyman and Scott made their celebrated contributions to astronomy the two fields have drifted apart. Beyond doubt, astronomers have become more statistically sophisticated, but statisticians still have much to offer them. We hope that these papers entice some readers to consider getting involved in this area. From the study of planets, to stars and galaxies, and on up to the fate of the Universe, a plethora of questions, an abundance of data and no end of interesting challenges remain.

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