Contents

Part I  Statistics in Cosmology

1  Likelihood-Free Inference in Cosmology: Potential for the Estimation of Luminosity Functions ............................. 3
   Chad M. Schafer and Peter E. Freeman

2  Commentary: Likelihood-Free Inference in Cosmology: Potential for the Estimation of Luminosity Functions ............... 21
   Martin A. Hendry

3  Robust, Data-Driven Inference in Non-linear Cosmostatistics ........ 27
   Benjamin D. Wandelt, Jens Jasche, and Guilhem Lavaux

4  Simulation-Aided Inference in Cosmology .............................. 41
   David Higdon, Earl Lawrence, Katrin Heitmann, and Salman Habib

5  Commentary: Simulation-Aided Inference in Cosmology ............. 59
   Carlo Graziani

6  The Matter Spectral Density from Lensed Cosmic Microwave Background Observations ................................. 65
   Ethan Anderes and Alexander van Engelen

7  Commentary: ‘The Matter Spectral Density from Lensed Cosmic Microwave Background Observations’ ....................... 79
   Alan Heavens

8  Needlets Estimation in Cosmology and Astrophysics ................... 83
   Domenico Marinucci
Part II  Bayesian Analysis Across Astronomy

9  Parameter Estimation and Model Selection in Extragalactic Astronomy .................................................. 101
Martin D. Weinberg

10  Commentary: Bayesian Model Selection and Parameter Estimation ............................................................. 117
Philip C. Gregory

11  Cosmological Bayesian Model Selection: Recent Advances and Open Challenges ........................................ 127
Roberto Trotta

12  Commentary: Cosmological Bayesian Model Selection ............. 141
David A. van Dyk

13  Measurement Error Models in Astronomy ........................................ 147
Brandon C. Kelly

14  Commentary: “Measurement Error Models in Astronomy” by Brandon C. Kelly ............................................ 163
David Ruppert

15  Asteroseismology: Bayesian Analysis of Solar-Like Oscillators ...... 171
Othman Benomar

16  Semi-parametric Robust Event Detection for Massive Time-Domain Databases ........................................ 177
Alexander W. Blocker and Pavlos Protopapas

17  Bayesian Analysis of Reverberation Mapping Data .................. 189
Brendon J. Brewer

18  Bayesian Mixture Models for Poisson Astronomical Images ........ 197
Fabrizia Guglielmetti, Rainer Fischer, and Volker Dose

19  Systematic Errors in High-Energy Astrophysics ....................... 203
Vinay Kashyap

20  Hierarchical Bayesian Models for Type Ia Supernova Inference ...... 209
Kaisey S. Mandel

21  Bayesian Flux Reconstruction in One and Two Bands ............... 219
Eric R. Switzer, Thomas M. Crawford, and Christian L. Reichardt

22  Commentary: Bayesian Analysis Across Astronomy .................. 225
Thomas J. Loredo
Part III  Data Mining and Astroinformatics

23 Sparse Astronomical Data Analysis ........................................ 239
   Jean-Luc Starck

24 Exploiting Non-linear Structure in Astronomical Data
   for Improved Statistical Inference ........................................ 255
   Ann B. Lee and Peter E. Freeman

25 Commentary: Exploiting Non-linear Structure in Astronomical
   Data for Improved Statistical Inference .................................. 269
   Didier Fraix-Burnet

26 Surprise Detection in Multivariate Astronomical Data .............. 275
   Kirk D. Borne and Arun Vedachalam

27 On Statistical Cross-Identification in Astronomy .................... 291
   Tamás Budavári

28 Commentary: On Statistical Cross-Identification in Astronomy ...... 303
   Thomas J. Loredo

29 Data Compression Methods in Astrophysics ............................ 309
   Raul Jimenez

30 Commentary: Data Compression Methods in Astrophysics ......... 321
   Ann B. Lee

Part IV  Image and Time Series Analysis

31 Morphological Image Analysis and Sunspot Classification .......... 329
   David Stenning, Vinay Kashyap, Thomas C.M. Lee,
   David A. van Dyk, and C. Alex Young

32 Commentary: Morphological Image Analysis and Sunspot
   Classification ................................................................. 343
   Ricardo Vilalta

33 Learning About the Sky Through Simulations .......................... 347
   Andrew Connolly, John Peterson, Garret Jernigan, D. Bard
   and the LSST Image Simulation Group

34 Commentary: Learning About the Sky Through Simulations ........ 361
   Michael J. Way

35 Statistical Analyses of Data Cubes ..................................... 367
   Erik Rosolowsky

36 Astronomical Transient Detection Controlling the False
   Discovery Rate ..................................................................... 383
   Nicolle Clements, Sanat K. Sarkar, and Wenge Guo
### Part V  The Future of Astrostatistics

<table>
<thead>
<tr>
<th>Page</th>
<th>Title</th>
<th>Authors</th>
</tr>
</thead>
<tbody>
<tr>
<td>40</td>
<td>Astrostatistics in the International Arena</td>
<td>Joseph M. Hilbe</td>
</tr>
<tr>
<td>42</td>
<td>Panel Discussion: The Future of Astrostatistics</td>
<td>G. Jogesh Babu</td>
</tr>
</tbody>
</table>

### Part VI  Contributed Papers

<table>
<thead>
<tr>
<th>Page</th>
<th>Title</th>
<th>Authors</th>
</tr>
</thead>
<tbody>
<tr>
<td>43</td>
<td>Bayesian Estimation of log N — log S</td>
<td>Paul D. Baines, Irina S. Udaltsova, Andreas Zezas, and Vinay L. Kashyap</td>
</tr>
<tr>
<td>44</td>
<td>Techniques for Massive-Data Machine Learning in Astronomy</td>
<td>Nicholas M. Ball</td>
</tr>
<tr>
<td>45</td>
<td>A Bayesian Approach to Gravitational Lens Model Selection</td>
<td>Irene Balmès</td>
</tr>
<tr>
<td>46</td>
<td>Identification of Outliers Through Clustering and Semi-supervised Learning for All Sky Surveys</td>
<td>Sharmodeep Bhattacharyya, Joseph W. Richards, John Rice, Dan L. Starr, Nathaniel R. Butler, and Joshua S. Bloom</td>
</tr>
<tr>
<td>47</td>
<td>Estimation of Moments on the Sphere by Means of Fast Convolution</td>
<td>P. Bielewicz, B.D. Wandelt, and A.J. Banday</td>
</tr>
<tr>
<td>48</td>
<td>Variability Detection by Change-Point Analysis</td>
<td>Seo-Won Chang, Yong-Ik Byun, and Jaegyoon Hahm</td>
</tr>
<tr>
<td>49</td>
<td>Evolution as a Confounding Parameter in Scaling Relations for Galaxies</td>
<td>Didier Fraix-Burnet</td>
</tr>
<tr>
<td>Chapter</td>
<td>Title</td>
<td>Authors</td>
</tr>
<tr>
<td>---------</td>
<td>----------------------------------------------------------------------</td>
<td>---------------------------------------------------------------</td>
</tr>
<tr>
<td>51</td>
<td>Multi-component Analysis of a Sample of Bright X-Ray Selected Active Galactic Nuclei</td>
<td>Dirk Grupe</td>
</tr>
<tr>
<td>52</td>
<td>Applying the Background-Source Separation Algorithm to Chandra Deep Field South Data</td>
<td>F. Guglielmetti, H. Böhringer, R. Fischer, P. Rosati, and P. Tozzi</td>
</tr>
<tr>
<td>53</td>
<td>Non-Gaussian Physics of the Cosmological Genus Statistic</td>
<td>J. Berian James</td>
</tr>
<tr>
<td>54</td>
<td>Modeling Undetectable Flares</td>
<td>Vinay Kashyap, Steve Saar, Jeremy Drake, Kathy Reeves, Jennifer Posson-Brown, and Alanna Connors</td>
</tr>
<tr>
<td>55</td>
<td>An F-Statistic Based Multi-detector Veto for Detector Artifacts in Gravitational Wave Data</td>
<td>D. Keitel, R. Prix, M.A. Papa, and M. Siddiqi</td>
</tr>
<tr>
<td>56</td>
<td>Constrained Probability Distributions of Correlation Functions</td>
<td>D. Keitel and P. Schneider</td>
</tr>
<tr>
<td>57</td>
<td>Improving Weak Lensing Reconstructions in 3D Using Sparsity</td>
<td>Adrienne Leonard, François-Xavier Dupé, and Jean-Luc Starck</td>
</tr>
<tr>
<td>58</td>
<td>Bayesian Predictions from the Semi-analytic Models of Galaxy Formation</td>
<td>Yu Lu, H.J. Mo, Martin D. Weinberg, and Neal Katz</td>
</tr>
<tr>
<td>59</td>
<td>Statistical Issues in Galaxy Cluster Cosmology</td>
<td>Adam Mantz, Steven W. Allen, and David Rapetti</td>
</tr>
<tr>
<td>60</td>
<td>Statistical Analyses to Understand the Relationship Between the Properties of Exoplanets and Their Host Stars</td>
<td>Elizabeth Martínez-Gómez</td>
</tr>
<tr>
<td>61</td>
<td>Identifying High-z Gamma-Ray Burst Candidates Using Random Forest Classification</td>
<td>Adam N. Morgan, James Long, Tamara Broderick, Joseph W. Richards, and Joshua S. Bloom</td>
</tr>
<tr>
<td>62</td>
<td>Fitting Distributions of Points Using $\tau^2$</td>
<td>Tim Naylor</td>
</tr>
</tbody>
</table>
Contents

63 Theoretical Power Spectrum Estimation from Cosmic Microwave Background Data ............................................. 539
  Paniez Paykari, Jean-Luc Starck, and M. Jalal Fadili

64 Guilt by Association: Finding Cosmic Ray Sources Using Hierarchical Bayesian Clustering ......................................... 543
  Kunlaya Soiaporn, David Chernoff, Thomas Loredo, David Ruppert, and Ira Wasserman

65 Statistical Differences Between Swift Gamma-Ray Burst Classes Based on \( \gamma \)- and X-ray Observations .................................................. 547
  Dorottya Szécsi, Lajos G. Balázs, Zsolt Bagoly, István Horváth, Attila Mészáros, and Péter Veres

66 A Quasi-Gaussian Approximation for the Probability Distribution of Correlation Functions ........................................ 551
  Philipp Wilking and Peter Schneider

67 New Insights into Galaxy Structure from GALPHAT .................. 555
  Ilsang Yoon, Martin Weinberg, and Neal Katz

Index .................................................................................................................. 557
Statistical Challenges in Modern Astronomy V
Feigelson, E.D.; Babu, J. (Eds.)
2012, XXIII, 559 p. 131 illus., 78 illus. in color., Softcover
ISBN: 978-1-4614-3519-8