ACMS Statistics Seminar

Simon Birrer
Tuesday, September 25
154 Hurley Hall
3:30– 4:30 PM

Probing Dark Matter and Dark Energy With Strong Gravitational Lensing – A Statistics Challenge View

Gravitational lensing is a unique phenomena to probe the composition and scales of our universe and as such to shed light on the unknown physics of dark matter and dark energy.

In my talk, I will give a brief introduction in gravitational lensing and the observables we can access from its effect. I focus in my talk on the statistical challenges in extracting the necessary information from the exquisite data sets in hand. Among the challenges are: deconvolution, sparsity regularization, time-series analysis, high-dimensional linear and non-linear optimization, Approximate Bayesian Computing, Bayesian model selection and the use of extensive forward modeling. The current analysis techniques and data sets result in a 3% precision measurement on the expansion rate of the universe and the composition analysis can rule out thermally produced dark matter particles above an equivalent thermal mass of
2 keV. In the near future, we can expect significant advances to further constrain dark matter and dark energy with strong gravitational lensing probes.

The Department of Applied and Computational Mathematics and Statistics
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