From Photons to Physics

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Abstract

Upcoming intensity mapping experiments will in principle contain vast amounts of information about physics ranging from galaxy evolution to large-scale structure. However, actually extracting this information from these surveys is a challenging task. Conventionally, surveys are analyzed in terms of their power spectra, but this statistic can only probe limited aspects of highly non-Gaussian intensity fields. In this talk, I will discuss how methods beyond the auto power spectrum can be used to interpret line intensity maps. I will show how cross-correlations, both those between maps of different lines and between intensity maps and galaxy surveys, can "project out" different aspects of the underlying emitter population, and provide important tests against foregrounds and systematics. I will further demonstrate that one-point statistics such as the Voxel Intensity Distribution can access non-Gaussian information missing from all types of power spectra. I will then describe an exciting new method which combines the advantages of both cross-correlation and one-point analyses. Finally, I will close with a discussion of how all of these analytic techniques can be supplemented with machine learning methods.

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