

Big Data Astronomy: Studying Star Formation and Astrochemistry

Brandt Gaches
Department of Astronomy
UMass Amherst

Star formation occurs entirely in molecular clouds, which are observed through radio molecular line emission. In this talk, I will discuss how large-scale numerical simulations can be used to interpret observations and make predictions. I used a hydrodynamic simulation of a molecular cloud which has been post processed to obtain abundances for a large number of chemical species and synthetic observations for a subset of these. I performed statistical analysis on this large dataset using the Spectral Correlation Function (SCF) to measure correlations between the structures traced by different species. The SCF slope naturally separates out the molecular species into three distinct groups: diffuse tracers which exhibit a simple early time chemistry, intermediate density tracers, and dense gas tracers which include more complicated late time chemistry, including hydrocarbons. The results of this study provide a quantitative measure of the density structure traced by different molecules and provides guidance for selecting species for observational studies.