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Probing The Non-Linearity in Galaxy Clusters Through The Analysis of Fractal Dimension[1] LOAY KHALIFA, DePaul University — The study of large scale structure (LSS) of the universe using both all-sky surveys and numerical simulations has become an increasingly important tool to calculate different cosmological parameters. We developed a new computational technique to analyze the fractal properties of the galaxies under the study. This thesis uses both real and simulated data combined with a unique approach to characterizing LSS. The main tools of the research are the wavelet transform methods as applied to fractal based-point processes statistics. Specifically, this thesis calculates the fractal dimension as a function of the cosmological redshift using the Baryon Oscillation Spectroscopic Survey (BOSS). We compare these results to mock data sets produced by the Sloan Digital Sky Survey (SDSS). Taking advantage of the self-similarity and localization properties of the wavelets, allows us to compute the fractal dimension of galaxies in narrow redshift bins. The narrow bins assure that dynamical evolution has not occurred. Because fractal behavior provides us with an indication about linear and non-linear regimes, we believe that we can use this measure to demarcate the point at which dark energy becomes the dominant component governing the evolution of the universe.

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Loay Khalifa
DePaul University

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