SubHalo Abundance Matching for eBOSS galaxies

Master's Thesis

Jiaxi Yu

jiaxi.yu@epfl.ch

Laboratory of Astrophysics
EPF Lausanne

Supervisors:
Prof. Dr. Jean-Paul Kneib
Dr. Cheng Zhao

June 18, 2020

Acknowledgements

I would like to thank my supervisor Dr. Cheng Zhao. He has taught me how to understand the science behind the research and has been supportive during my master project. I am also grateful to my thesis advisor Prof. Dr. Jean-Paul Kneib. His lectures have ignited my passion for cosmology and prepared me for the research in this field. I also need to thank Dr. Chia-Hsun Chuang for his guidance in my master project. Dr. Anand Raichoor, Amélie Tamone, Andrei Variu and Daniel Forero Sanchez have also helped me a lot. Thank you so much. There had been days when life was full of frustration and anxiety. Owning to the encouragement from my friends in America and in China, I managed to digest those negative thoughts and live a happy life again. Last but not least, I would like to express my thankfulness to my parents. Their unconditional support has enabled me to broaden my horizon and become more resilient. The COVID-19 has had an impact on the world, and people have been deprived of lives, careers and the joy of travelling and meeting with others. I hope the vaccine can come out and society can go back to normal as soon as possible.

Abstract

In order to restore the galaxy clustering of eBOSS galaxies, we apply the SubHalo Abundance Matching (SHAM) method to the UNIT N-body simulation. The eBOSS galaxy sample contains 174,816 LRGs at $0.6 < z < 1.0$ and 173,736 ELGs at $0.6 < z < 1.1$. To mitigate the fibre collision effects, their correlation functions are calculated using the pairwise-inverse-probability and angular up-weighted (PIP+ANG) pair counts. The covariance matrices of the correlation function multipoles are obtained from 1000 realisations of the multi-tracer Ezmocks. We use the peak maximum circular velocity over the mass accretion history (i.e., $V_{\rm peak}$) in the SHAM study. The SHAM models are the same for LRGs and ELGs, with a scattering parameter σ and the massive-end truncate parameter $V_{\rm cut}$. The SHAM ELGs agree well with the observations in both NGC and SGC, with a typical $V_{\rm peak} \approx 230 km/s$ for their host halos. But there are discrepancies for LRG quadrupoles on small scales. This problem is solved by taking into account the redshift uncertainty in LRG SHAM models. This uncertainty is modelled by Gaussian smearing in SHAM LRGs' peculiar velocity. The host halos of LRG has a typical $V_{\rm peak} \approx 700 km/s$, three times larger than ELG host halos. It implies typical halos that host an LRG are 9 times more massive than the typical host halos of ELGs.