P7: Measurement of the weak lensing signal of galaxy clusters and their halo density profile

Background: Galaxy clusters form at the rarest peaks in the initial density field and their abundance is quite sensitive to cosmological parameters. However, it is important to calibrate their masses before they can be used as cosmological probes. Weak gravitational lensing is one of the important techniques to carry out such mass calibration for galaxy clusters. This lensing signal is imprinted on the shapes of background galaxies and needs to be statistically measured.

Project Goal: We will use publicly available data from the Dark energy survey and build a python based pipeline to measure the weak lensing signal of galaxy clusters. We will then learn how to fit this signal to infer the masses of these clusters, and if time permits to liaise with Project 1 to also measure the splashback radius of these clusters using weak gravitational lensing.

Necessary Concepts: Basic understanding of gravitational dynamics, concepts like correlation function, modelling and parameter estimation. Basic coding in python or C, C++.

Resources:
Intro to cosmology by Barbara Ryden (Cambridge, free version), Review on clusters - https://arxiv.org/pdf/1205.5556.pdf Emcee

Miyatake et al 2019
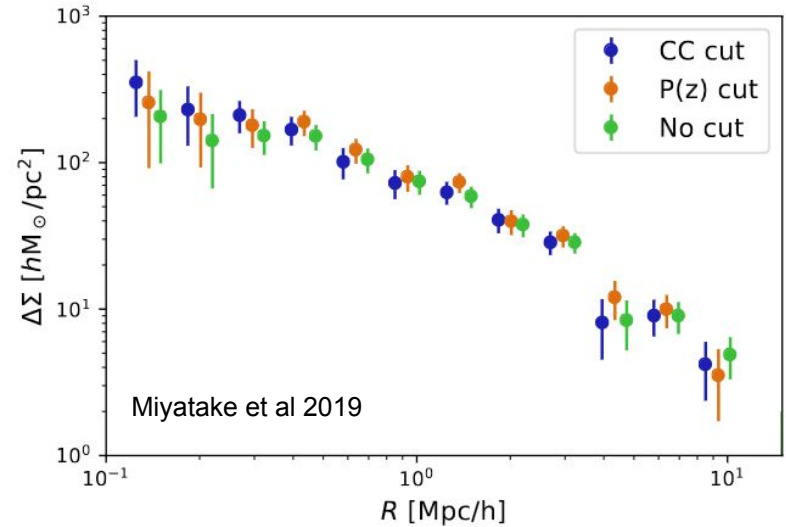
Surhud More
Inter-University Center for
Astronomy and Astrophysics, Pune