

Post-graduate lectures: IDL Project

Introduction

Choose one of the three projects described below, and solve them. Write a short text how your programme works, include the idl programmes, their output, and links to those idl resources that you've used, and put this onto google docs. Teams choosing the same project should mark each other's write-ups, using the marking scheme provided. Deadline is Nov 17th. Briefly present your results on Nov 19th. Deadline for providing marks is Nov 20th.

1. Project 1: identifying stars in an image

- (a) Download the example fits file [m13dss.fits](#)
- (b) Write an idl programme to read the fits file, and print out all the header information. Write an idl program to display the image, and save a colour representation in .png format [5 marks]
- (c) Write an idl programme that identifies stars in the image. Hint: identify stars as maxima in the flux in a smoothed version of the image. [10 marks]
- (d) Extract fluxes of stars within a fixed aperture, and make a histogram of stellar fluxes. [5 marks]

2. Project 2: creating a Gaussian random field

The cosmological linear density field is thought to be a 3D Gaussian random field. This project lets you generate such a field, and test its statistical properties

- (a) Find a fit to the CDM power spectrum (for example from the paper by [Bardeen, Bond, Kaiser & Szalay](#), and plot $P(k)$ [5 marks]
- (b) Use the definition of Gaussian random field (see for example [my cosmology lecture notes](#), and generate a linear density field with the given power spectrum, on a 256^3 grid, where the box size corresponds to $100 h^{-1}$ Mpc. Normalise the power spectrum to $\sigma_8 = 0.9$. [10 marks]
- (c) Compute the variance in spheres of $8 h^{-1}$ Mpc, and verify it corresponds with your imposed value of σ_8 . [5 marks]

3. Project 3: the star formation history inferred from GIMIC

Use an output from the GIMIC simulations to compute and plot the star formation history. These simulation are described in detail in the paper by [Crain et al, 2009](#).

- (a) Get a copy of a data file of the GIMIC project from
/data/rw12/tt/GIMIC/Sigma0/Run/Data/Snapshots/snapshot_058.
Use h5_browser, or download [hdfview](#), to get an idea of what is in these data files.
- (b) Write a simple idl programme to read all the properties of the stellar particles (stars are PartType4) [5 marks]
- (c) Use the ages of the stars to construct a ‘Madau-Lilly’ diagram (star formation rate density, $\dot{\rho}_*(z)$, as function of redshift. [5 marks]
- (d) Extract the density, and positions of the gas particles. Make an image of one of the galaxies, superposing stellar density on top of gas density. [5 marks]
- (e) Extract the temperature of the gas. Make a scatter plot of density (in units of the mean density), versus temperature. Represent this plot as a 2D histogram. Superpose a colour bar to indicate which colour corresponds to which particle density. [5 marks]

Important: Make sure you upload all plots, the programmes you write, and a link to idl resources that you used, onto your google document. Then allow me access to the document.