

Level of the project: Honours

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**Project title: A dynamical analysis of the massive cluster VC04 in the Vela supercluster**

## Project Description:

We are conducting a campaign to study and learn more about the properties of the Vela Supercluster (VSCL) located behind the Milky Way at  $cz \sim 18000 \text{ km s}^{-1}$ . The VSCL is an extended structure across the Zone of Avoidance (ZoA) at  $cz \sim 18000 \text{ km s}^{-1}$ , which may add an appreciable contribution to the residual bulk flow generated at distances beyond  $\sim 16000 \text{ km s}^{-1}$ . We have studied five galaxy clusters using deep NIR ( $JHK_s$ ) observations (with IRSF) which are complete to extinction-corrected absolute magnitude of  $M_{K_s}^o < -21.5 \text{ mag}$  at the distance of the VSCL ( $\sim 2.5 \text{ mag}$  below  $M_K^*$ ), within the clustercentric radius of  $r_c < 1.5 \text{ Mpc}$  ( $\sim 70\%$  of the Abell radius). VC04 is the richest known galaxy cluster in the VSCL, for which we obtained 90 new spectroscopic redshifts of galaxies with SALT. The iso-density contour map (two-dimensional test) of VC04 and the spectroscopic information of galaxies suggest VC04 to be a not yet fully relaxed cluster. The brightest galaxy of VC04 lies outside of  $r < 0.5 \text{ Mpc}$ , within a small density enhancement (north-east, see Figure 1). We would like to perform a dynamical analysis on VC04 using a three-dimensional test to analyse its structure. The Dressler–Shectman (DS)  $\delta$ -test (Dressler & Shectman 1988) is a particularly powerful and frequently used method to quantify substructure (using velocity and positional information). In this projects the student will measure the velocity dispersion of galaxies with known redshift measurements using their optical spectra and will perform the DS  $\delta$ -test on the VC04 cluster to probe substructures in this cluster. The student must be familiar with Python programming and having experience with IRAF is desirable.

## Useful links:

<https://ui.adsabs.harvard.edu/abs/2008MNRAS.383..445W/abstract>

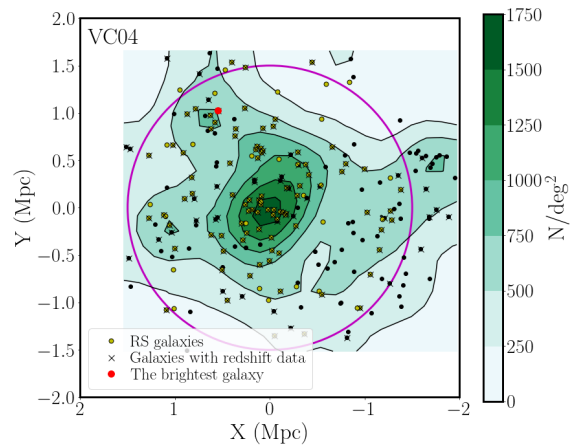


Figure 1: The iso-density contour map of VC04 complete to  $M_{K_s}^o < -21.5 \text{ mag}$ . The galaxies are shown as black dots and the red-sequence galaxies as yellow dots. The spectroscopically confirmed members of VC04 are depicted as black crosses. The magenta circle represents  $r_c = 1.5 \text{ Mpc}$ .