OTELO:

The Stellar Component of the Groth Field

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and the OTELO collaboration

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OTELO, the key OSIRIS science project, is a deep emission line object survey to be performed with the OSIRIS Tunable Filters, in selected atmospheric windows relatively free of sky emission lines. The observing strategy will allow studying a clearly defined volume of the Universe at a known flux limit. The total survey sky area is about 1 square degree, distributed in different low extinction fields with adequate angular separations. The survey will result in 3D data cubes covering 150+180 Å wavelength intervals at spectral resolution of ~700, from which spectra of the different sources will be retrieved. OTELO is not only unbiased, but its 5σ depth of 1×10^{-18} erg/cm^2/s will make **OTELO the deepest emission line survey** to date.

BROAD BAND SURVEY

An auxiliary broad band survey has been undertaken in order to provide:

- Morphological identification
- Photometric redshift
- Environment of the sources
- Percentage of emission line targets
- Approximate population synthesis

REDUCTION AND EXTRACTION OF SOURCES

Reduction sets followed standard steps using IRAF packages.

Absolute astrometry: the USNO B1 catalogue was used.

Sextractor2.2 (Bertin & Arnouts 1996) has been used to extract sources. A minimun detection area of 20pixels (seeing disk) and a detection threshold of 1.5 sigma were adopted.

In order to match the catalogs, we took 1" as the largest distance for identification of objects in two catalogs.

PHOTOMETRIC CALIBRATION

- Selection of calibration stars:
  - Objects with stellarity > 0.9 (Sextractor parameter)
  - Common stars in all frames in each filter
  - Instrumental magnitude > 17. (linearity range)
  - Matched stars with Sloan Digital Sky Survey (SDSS) stars
- In each frame, fit transformation equations:

$$B - B_{SDSS} = ab1 + ab2\,(B_{SDSS} - V_{SDSS})$$
$$V - V_{SDSS} = av1 + av2\,(B_{SDSS} - V_{SDSS})$$
$$R - R_{SDSS} = ar1 + ar2\,(B_{SDSS} - R_{SDSS})$$
$$I - I_{SDSS} = ai1 + ai2\,(V_{SDSS} - I_{SDSS})$$

- Images with very different transformations coefficients are rejected
- Combination of all good frames in each filter.
- New fit for combined images in each pointing. ➡ Calculation of coefficients in the tranformation equations. ➡ Inverse tranformations. ➡ Determination of colors ➡ MAGNITUDE
- Comparation between the three pointings ➡ Determination of final average zero point

Groth 3 section (8'x16') obtained from B, V and R filters images.

OBSERVATIONS

Field selection criteria based on the low galactic extinction, low stellar density and absence of bright objects in the field.

The sky region called GROTH is one of the selected field as part of the OTELO project. GROTH is a commonly observed sky region for different scientific aims in extragalactic astronomy.

Observations were carried out along several runs using the Prime Focus Camera at the 4.2m William Herschel Telescope (WHT) of the Observatorio del Roque de los Muchachos (La Palma, Canary Islands).

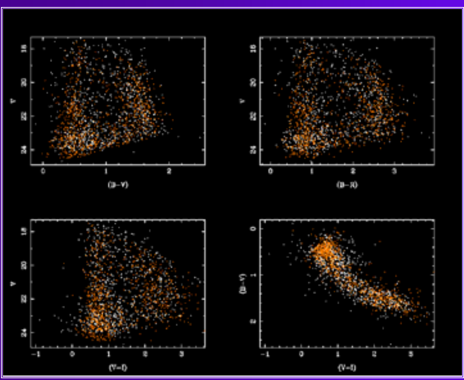
Resolution is 0.2

Three different pointings were observed in the direction of GROTH, covering a total area of 0.18 deg^2.

FIELD	RA	DEC	FILTER	EXP. TIME	SEEING
GROTH1	14 16 35.0	+52 16 25.0	B	9000	1.2
			V	9000	1.0
			R	8100	1.0
			I	8400	1.0
GROTH2	14 17 36.2	+52 28 04.0	B	6000	1.1
			V	9000	1.0
			R	6300	1.0
			I	9000	1.2
GROTH3	14 15 34.8	+52 04 45.0	B	9000	1.1
			V	9000	1.1
			R	9000	1.2
			I	9000	1.2

Transformation equations used for the selected SDSS stars (Lupton 2005)

$$B = g + 0.3130\,(g - r) + 0.2271;\ \sigma = 0.0107$$
$$V = g - 0.5784\,(g - r) - 0.0038;\ \sigma = 0.0054$$
$$R = r - 0.2936\,(r - i) - 0.1439;\ \sigma = 0.0072$$
$$I = r - 1.2444\,(r - i) - 0.3820;\ \sigma = 0.0078$$



Color/magnitude and color/color diagrams for our sample of stars (white points) and the Besançon model stars (orange points).

BESANÇON MODELS

The Besançon models (Robin et al 2003) are based on a population synthesis scheme. It includes:

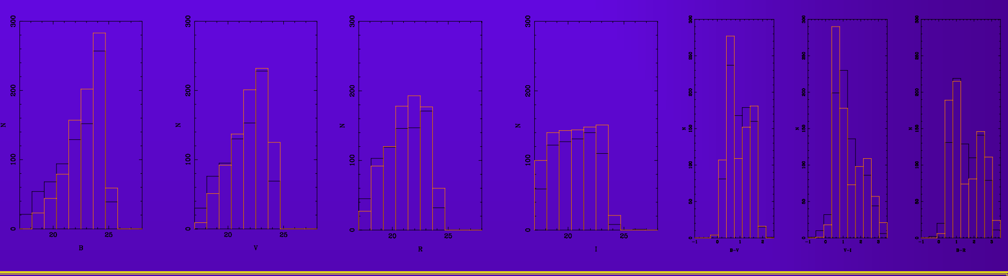
1. Four distinct populations: a thin disk, a thick disk, a bulge and a spheroid.
2. Each population is described by a SFR history, an IMF, an age or age-range, a set of evolutionary tracks, kinematics, metallicity characteristics, and includes a white dwarf population.
3. Density laws for the thin disc are constrained self-consistently by the potential via the Boltzmann equation and are age dependent.
4. The extinction is modeled by a diffuse thin disc.

The resulting model can be used for simulations of the galactic stellar populations in any directions in photometric bands UBVRIJHKL.

Input parameters: *galactic coordinates+field size; intervals of apparent magnitude in each band; photometric errors.*

Selected stars limiting magnitudes: 25. (B); 24.5 (V); 24.5 (R); 24. (I)

Output: *photometric catalogue of stars.*



Comparison of stellar number counts in each photometric band and different colors for our catalogue of stars (black) and Besançon model stars (orange).

CATALOGUE OF STARS

Final catalogue has ~ 45000 objects

Selection of stars (in order to compare with Besançon models):

Objects detected in all filters

Stellarity > 0.9 in all filters

➡ ~ 850 survival stars, 2% of total sources.

Test for the goodness of the stellarity parameter to separate stars of galaxies.:

Simulation of point sources in science images

Separation through Sextractor separation

➡ For B and V filters, between 19 and 24.5 magnitude only 1% of the point sources are misclassified.

➡ For R and I filters significative differences are over 23.

The good agreement between our observations and the model predictions gives confidence about our photometric calibration and the completness of our catalogue.

Note that both the observed **color distribution** and the **number counts** are well reproduce by the model.

LIMITING MAGNITUDES

Simulations of artificial point sources in background real images in random coordinates in order to estimate limiting magnitudes.

Limiting magnitudes (at 50% detection efficiency) are: 26. (B band); 26. (V band); 26. (R band) and 24. (I band)

REFERENCES

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