Deep BVR photometry of the Chandra Deep Field South from the COMBO-17 survey

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We report on deep multi-color imaging ($R_{5σ} = 26$) of the Chandra Deep Field South, obtained with the Wide Field Imager (WFI) at the MPG/ESO 2.2 m telescope on La Silla as part of the multi-color survey COMBO-17. As a result we present a catalogue of 63501 objects in a field measuring $315 \times 30$ with astrometry and BVR photometry. A sample of 37 variable objects is selected from two-epoch photometry. We try to give interpretations based on color and variation amplitude. Techniques: image processing – Techniques: photometric – Surveys – Catalogs – quasars: general

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Introduction

Deep fields have become a favourite tool of observational cosmology, particularly in conjunction with the construction of multiwavelength datasets. Besides the ubiquitous Hubble Deep Fields, another illustrative example is the ROSAT Deep Survey in the Lockman Hole (Hasinger et al. 1998) and its optical follow-up by imaging and spectroscopy (e.g., Schmidt et al. 1998). However, full spectroscopic coverage is usually impossible to obtain, and the reconstruction of distances often has to rely on photometric redshift estimation. Despite major advances in this area, there is always a certain degree of degeneracy between object classes, such as different galaxy types, and their redshifts. Breaking this degeneracy is possible only by incorporating independent spectroscopic information, such as adding infrared colors or moving towards finer spectrophotometric resolution.

Wolf, Meisenheimer, & Röser (2001) and Wolf et al. (2001) demonstrated that the use of medium-band filters leads to a substantial gain in classification accuracy and discriminative power, as compared to simple broad-band photometry. In 1999 we initiated a new multicolor survey using the Wide Field Imager (WFI, Baade et al. 1998, 1999) at the MPG/ESO 2.2 m telescope on La Silla, Chile. The survey was designed to make full use of the capabilities of the WFI in the 17 filters used in the COMBO-17 project. The overall objectives of COMBO-17 are:

1. The galaxy catalogue will be complete to $R < 24$ and contain $\sim 50,000$ galaxies with accurate redshifts and spectral classification up to $z \sim 1.5$, to be used to study the evolution of the galaxy luminosity function and clustering properties.
2. The quasar sample will contain $\sim 500$ QSOs, with nearly uniform completeness over the redshift range $0.5 < z < 5$, well suited to trace the turnover in QSO evolution.
3. Deep high-resolution $R$-band images with 0.75 FWHM permit morphological classification and gravitational lensing studies.