PRECISE NEAR-IR ASTROMETRY AND PHOTOMETRY OF SOUTHERN ICRF QUASARS

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ABSTRACT. We present high quality astrometry along with photometry for 30 southern ICRF quasars observed with the ESO NTT/SOFI at La Silla, in the J, H and K_s bands. While the internal precision for the positions of these quasars is generally better than 10 mas, our best positional accuracy, as given by a set of 14 quasars observed in an enlarged field of view, is 25 mas. Corrections for the field distortion of the camera have been applied to all images. The precision in magnitude determination is generally better than 0.04 mag. One of the objectives of this project is to provide initial candidates to the optical extension of the ICRF.

1. INTRODUCTION

The International Celestial Reference System (ICRS; Arias et al. 1995) is realized by the sub-milliarcsecond accurate positions of 212 extragalactic compact radio sources listed in the International Celestial Reference Frame (ICRF; Ma et al. 1998). In the GAIA perspective, a primary realization of the ICRS in the optical range is being considered, and the coincidence of the optical and radio frames is a natural concern.

In this context, a pilot observing program of 30 southern ICRF quasars was carried out in January 2003 with the ESO NTT/SOFI, with emphasis on astrometry but also with photometric objectives. The presented work is, in particular, an initial step towards the determination of very accurate optical positions of sources in the ICRF. The major results of this observing program are summarized below. For a more detailed discussion about the observations and data analysis, see Camargo et al. (2004).

2. RESULTS

Observed magnitudes, with precisions generally better than 0.04 mag, were derived from photometric measurements (calibrated with the 2MASS) in the J, H and K_s bands, and cover a range (11.5 - 17.3 mags in the K_s band) that includes most of the ICRF quasars. Figure 1, left panel, shows the distribution of the observed quasar magnitudes in these 3 bands. The derived mean spectral index $< \alpha >$ of the observed quasars is -1 ($F_\nu \propto \nu^\alpha$). These photometric measurements are important to evaluate the feasibility of detailed imaging of quasars with nearinfrared interferometry, considering that objects as faint as $K_s = 19$ may be detectable in the future with large optical telescopes and spatial phase-referenced imaging (Glindemann et al. 2003; Daigne & Lestrade 2003).

The astrometric reduction was carried out for single images and enlarged fields of view, all images being corrected for the field distortion of the camera. The enlarged fields of view consist of mosaics of overlapping images taken for a selected sub-sample of 14 quasars. Observations in this mode benefit from a larger number of reference (UCAC2) stars, as compared to single images. A global reduction technique was used for the astrometric analysis of these mosaics, with a resulting positional accuracy of 25 mas. This value should be compared to 35 mas, the positional accuracy derived for all 30 quasars from single-image analyses. Figure 1, right panel, shows individual gains of accuracy in the positions of the 14 selected quasars, by comparing their single-image and mosaic analysis results.

The quasar positions derived from the measurements in the 3 photometric filters show an internal precision generally better than 10 mas, a value comparable to the typical size of extended structures observed in quasar radio maps. An accuracy to this level may be reached from observations with the NTT/SOFI by means of denser stellar fields around the quasar positions, and would imply a more physical approach when comparing radio and optical positions in the future.

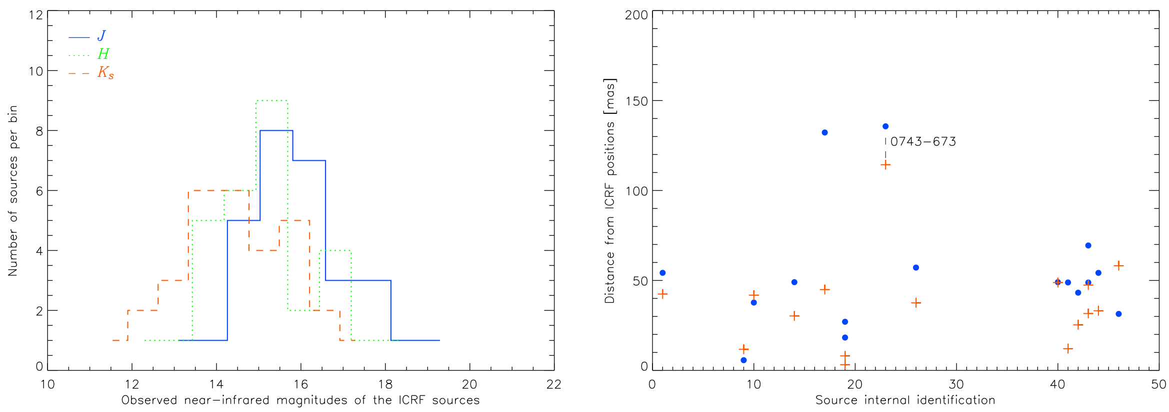

Figure 1: Left panel: Distribution of the observed quasar magnitudes in the J, H and K_s bands. Right panel: Accuracy of the positions derived from the astrometric analysis of single images (dots) and mosaics (crosses) to the 14 quasars observed with enlarged fields of view. It is interesting to notice that the ICRF candidate source 0743−673 (see right panel), presented a large systematic effect from both its single-image and mosaic analyses.

3. REFERENCES

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