

## The Araucaria Project. The distance to the Sculptor group galaxy NGC 7793 from near-infrared photometry of Cepheid variables

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**Abstract.** We performed deep near-infrared  $J$  and  $K$  photometry of a field in the Sculptor Group spiral galaxy NGC 7793 using ESO VLT and HAWK-I instrument. We produced a sample of 14 Cepheids whose locations and periods of pulsation were known from our previous paper on distance determination to this galaxy based on  $V$  and  $I$  bands. We determined mean  $J$  and  $K$  magnitudes based on measurements from two nights and produced period-luminosity relations for both filters. Using those near-infrared dependencies together with relations for bands  $V$  and  $I$  obtained before, we were able to obtain true distance modulus for NGC 7793. We also calculated the mean reddening affecting our Cepheids.

We present first near-infrared period-luminosity relations for Cepheids in NGC 7793. Using these data and optical data published before by Pietrzyński et al. (2010, [2]), we measured accurate distance to this galaxy based on four filters ( $V$ ,  $I$ ,  $J$ ,  $K$ ).

The near-infrared (NIR) data were collected with HAWK-I and ISAAC cameras installed on VLT telescopes in Cerro Paranal Observatory. From the optical catalogue of 14 Cepheids, we were able to identify 10 on our near-infrared images.

All Cepheids have photometry from 2 HAWK-I nights in 2011 and additionally 2 brightest Cepheids have also 1 data point obtained with ISAAC in 2005.

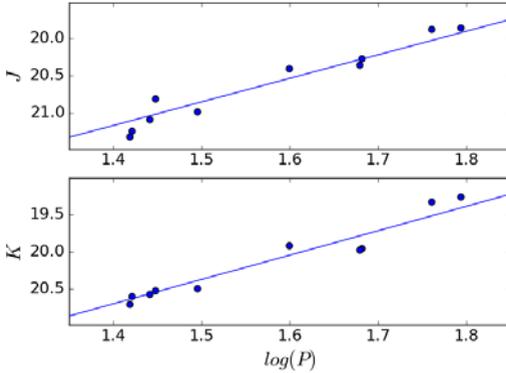
Assuming well defined slopes of near-infrared relations in the Large Magellanic Cloud by Persson et al. (2004, [1]), we fitted straight lines to period-luminosity relations of Cepheids in NGC 7793 using the least-squares method.

We adopted well determined distance to the Large Magellanic Cloud of Pietrzyński et al. (2013, [3]) as a zero point and fiducial period-luminosity relations for near-infrared bands for the Large Magellanic Cloud established by Persson et al. (2004, [1]).

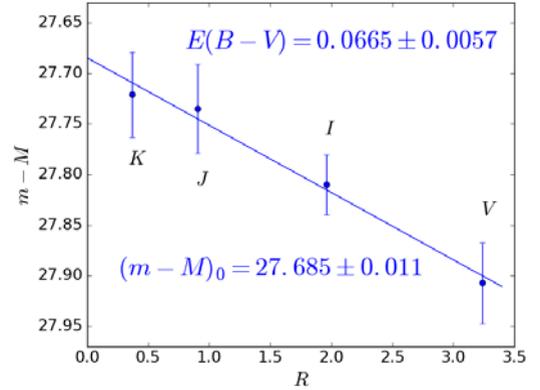
The observed distance modulus can be expressed in the following way:

$$(m - M)_\lambda = (m - M)_0 + R_\lambda E(B - V), \quad (1)$$

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**Figure 1.** Near-infrared periodluminosity relations for Cepheids in NGC 7793. Corresponding slopes were adopted from Persson et al. (2004, [1]). Periods are in days.



**Figure 2.** Apparent distance moduli to NGC 7793 as derived in the *VIJK* photometric bands, plotted against the ratio of total to selective extinction as adopted from Schlegel et al. (1998, [4]). The intersection and slope of the best-fitting line give the true distance modulus and the average total reddening, respectively.

where  $(m - M)_0$  is the true distance modulus,  $E(B - V)$  is color excess and  $R_l$  is a ratio of extinction in given band to the color excess.

Assuming the reddening law of Schlegel et al. (1998, [4]), we calculate the color excess,

$$E(B - V) = 0.0665 \pm 0.0057, \quad (2)$$

and true distance modulus to NGC 7793,

$$(m - M)_0 = 27.685 \pm 0.011 \pm 0.070, \quad (3)$$

which is presently the most accurate distance measurement to NGC 7793.

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## References

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