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# Near IR photometry of Cepheid variables in the LMC clusters NGC 1866 and NGC 2031

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**Abstract.** We present JHK photometry and light curves for a sample of cepheids in the two LMC young clusters NGC 1866 and NGC 2031. The reduced amplitude and dependence on metallicity allow us to derive precise mean magnitudes and to draw well defined P-L relations, which we find in good agreement with the P-L relation obtained in the IR for field cepheids.

**Key words.** Stars: cepheids – Galaxy: Magellanic Clouds – Techniques: photometry

## 1. Introduction

Cepheid variables have been extensively used to estimate the LMC distance modulus. Up to now, cepheids in cluster have been only studied in the optical with few exceptions (e.g. Storm et al. 2005). NGC 1866 is the most studied LMC cluster ever, and it is considered a benchmark for testing stellar evolution models (e.g. Testa et al. 1999; Walker et al. 2001; Barmina et al. 2002,and refs. therein). It is also well known for its large cepheid population. NGC 2031 is of an order of magnitude smaller in mass, has a similar age to NGC 1866 and contains also a considerable number of cepheids. The only available CMD in the literature up to now is from Mould et al. (1993).

## 2. Data set

Data have been acquired during 4 runs in Dec. 1992, Dec. 1993, Jan. 1995, Dec. 2001 using the 1m Swope at Las Campanas and the 2.2m ESO-MPI and the 3.5m ESO-NTT telescopes at La Silla. Reductions have been performed with DAOPHOT and DoPHOT to cross-check the photometric output. Calibrations have been reported to the Dec. 2001 run values and checked with the 2MASS catalog magnitudes.

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## 3. Light curves and Period-luminosity relation

For NGC 1866 periods are from Welch et al. (1991), Welch & Stetson (1993), and recently redetermined by Ripepi et al.(in prep; see also, Musella et al., this volume). For NGC 2031, periods are from Mateo (1992). Mean magnitudes are easily obtained with a plain weighted mean, where the weights are the photometric errors. Fig. 1 shows an example light curve.

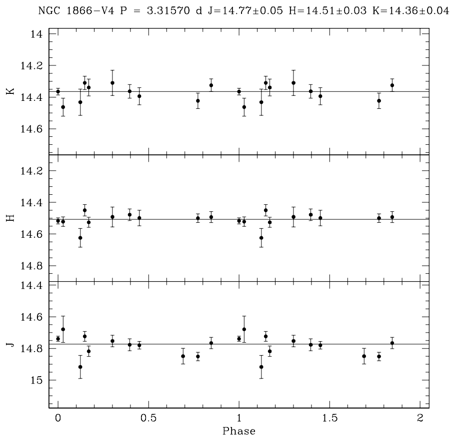


**Fig. 1.** Light curves for variable V4 of NGC 1866.

Magnitudes vs. *logP* for the two clusters are plotted in Fig. 2 and compared with the P-L for field LMC in the near IR from Persson et al. (2004). The agreement is good, and shows that, at least for these two clusters, the P-L relations are consistent with the one for the field. Moreover, we can extend the field relation toward shorter periods.

## 4. Discussion

The use of near IR bands permitted to obtain good mean magnitudes and colors from cepheids even with a sparse sampling of the light curve. Since the cluster sample is consistent with data for field cepheids from Persson et al. (2004), we can use cluster cepheids to extend the relation towards shorter periods. The inclusion of cluster variables makes slope slightly flatter and zero point slightly smaller. However, the values agree within $1\sigma$.

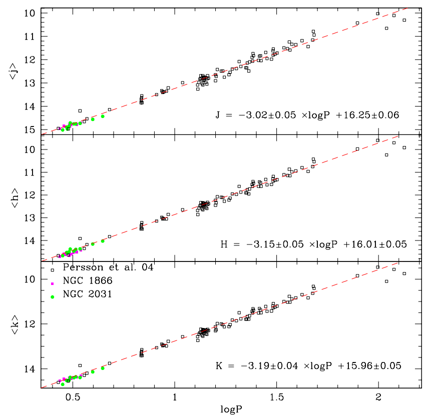


**Fig. 2.** Mag *vs logP* for the sample cepheids. Field cepheids from Persson et al. (2004) are plotted as empty squares. Dashed line shows a fit to the data including the cluster data.

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