THE K-BAND LUMINOSITY FUNCTION OF GALAXIES

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1. Introduction

The luminosity function of galaxies is central to many problems in cosmology, including the interpretation of faint number counts. The near-infrared provides several advantages over the optical for statistical studies of galaxies, including smooth and well-understood K-corrections and expected luminosity evolution. The K−band is dominated by near-solar mass stars which make up the bulk of the galaxy. The absolute K magnitude is a measure of the visible mass in a galaxy, and thus the K−band luminosity function is an observational counterpart of the mass function of galaxies.

2. Data

Previously the K−band luminosity function has remained poorly determined, relying on the results of small-area surveys, (Glazebrook *et al.* 1995), or samples selected in other bands (Mobasher, Sharples & Ellis 1993). We have conducted a photometric survey of 10 square degrees in the B, V, I and K−bands, (Gardner *et al.* 1996; Baugh *et al.* 1996), and obtained spectra of 564 galaxies selected at $K < 15$, achieving a 90% redshift identification rate.

3. Results

We present the first determination of the near-infrared K−band luminosity function of field galaxies from a wide field K−selected redshift survey. The best fit Schechter function parameters are $M^* = -23.12 + 5\log(h)$, $\alpha = -0.91$, and $\phi^* = 1.66 \times 10^{-2} h^3$ Mpc^{-3}. Based on extensive Monte

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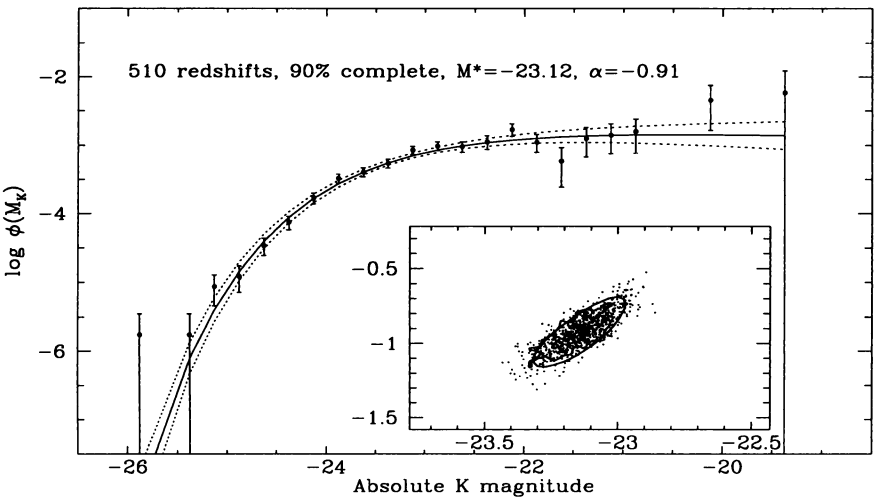

Figure 1. The differential K–band luminosity function of galaxies. The points, and their errors were determined from our data using the SWML method of Efstathiou, Ellis & Peterson (1988). The solid line is the best fit Schechter (1976) function determined using the maximum likelihood method. The dashed lines are the 1σ errors on this fit determined from the error ellipse, which is plotted in the inset figure. Also plotted are the results of 1000 Monte Carlo simulations of our survey parameters, and the 68% contour of the simulations.

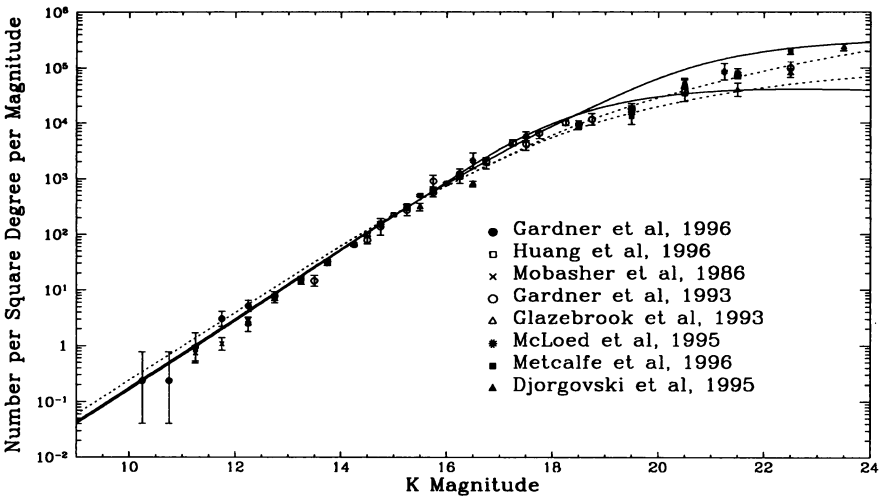

Figure 2. The K–band number counts with models based upon our luminosity functions. The solid lines include the effects of passive evolution, the dotted lines are pure K-correction models. The higher line in each case is for $q_0 = 0.02$, while the lower lines are for $q_0 = 0.5$. References for the data are given in Gardner *et al.* (1996).

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Carlo modelling, we estimate that systematics are no more than 0.1 mag in M^* and 0.1 in α, which is comparable to the statistical errors on this measurement.

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