## R32b Maximum Likelihood, Information Theory, and Galaxy Luminosity Function

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To determine the exact shape of the luminosity function (LF) of galaxies is one of the central problems in galactic astronomy and observational cosmology. The most popular method to estimate the LF is maximum likelihood, which is clearly understood with the concepts of the information theory. In the field of information theory and statistical inference, great advance has been made by the discovery of Akaike's Information Criteria (AIC). The definition is as follows: AIC $\equiv -2(\ln \mathcal{L}(\hat{\theta}) - K)$, where $\mathcal{L}$ is the likelihood function, $\hat{\theta}$ is the maximum likelihood estimator, and $K$ is the number of free parameters. The most suitable model is the one which minimizes the AIC. It enables us to perform a direct comparison among different types of models with different numbers of parameters, and provides us a common basis of the model adequacy, without ambiguity relevant to the choice of confidence levels. We applied AIC to the determination of the shape of the LF.

We first treated the estimation using stepwise LF (Efstathiou, Ellis, & Peterson 1988), and derived a formula to obtain the optimal bin number. In addition, we studied the method to compare the goodness of fit of the parametric form (Sandage, Tammann, & Yahil 1979) with stepwise LF.