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Salpeter Mass Functions of Young Populous Clusters in the LMC?

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1. The Magellanic Clouds as Laboratories for Deriving IMFs

Although astronomers are not able to perform experiments with their objects under study, the Magellanic Clouds provide quite well what we may call an "astrophysical laboratory" (see Westerlund, 1990, for a review on Magellanic Cloud research). An important topic which can be tackled by investigating Magellanic Cloud objects is the shape of the Initial Mass Function (IMF) of newly formed stars.

The question whether the mass spectrum of stars that are born in a star-forming region has a universal shape or varies according to some (still unknown) laws, is fundamental for understanding both star formation and galactic evolution. A theory of star formation which is unable to predict the IMF of stars will always be considered as incomplete. The stellar mass spectrum is of relevance for galaxy evolution, since it controls the supernova rate and generally the amount of energy injected into the interstellar medium by massive stars. Moreover, the yield of freshly synthesized elements is a direct function of the stellar mass spectrum.

It has long been acknowledged that the young populous star clusters in the Magellanic Clouds are principally ideal targets for the investigation of the mass spectrum of their stars: They offer a high number of stars and a large mass interval with an upper limit of 10–15 solar masses. Such conditions are not found in the Milky Way. On the other hand, the extreme crowding of the stars complicates severely the derivation of a reliable luminosity function.

The crowding difficulty appears indeed prominently in papers related to this subject. Elson et al. (1989) counted stars on photographic plates in the surroundings of several young populous clusters in the Magellanic Clouds and determined mass functions which were surprisingly flat. If we assume a power law description of the shape $dN = m^{-(1+x)}$ dm (where dN is the number of stars in the mass interval between m–dm and m+dm), then Elson et al. found values for x in the range $-0.8 < x < 0.8$). Remember that the population in the solar environment can be described by $x = 1.3$. A systematic difference between stellar mass functions in the Magellanic Clouds and in the Milky Way would be a very important result.

However, in a paper by Mateo (1989) on the same topic, a quite different conclusion was reached. Mateo performed CCD photometry in Magellanic Cloud clusters of a wide range in age, among