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MEMBERSHIP IN THE REGION OF THE OPEN CLUSTER NGC2244 VIA THE EM ALGORITHM

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A membership solution in the region of the Open Cluster NGC2244 can be found working from proper motions via the EM algorithm.

The Open Cluster NGC2244 is located at the center of the region H II NGC2237- 2247, known as the Rosette nebula. The proper motions of 287 stars of this region with $V \leq 14.00$ were published by Chiu & Van Altena (1981) and Cudworth (1976). The stellar membership is now solved working from proper motions using a multivariate mixture density model of two weighted normal heteroscedastic components; the maximum likelihood equations are solved via the EM EMMIX Fortran software (McLachlan et al., 1997, 2000, and http//www.maths.uq.edu.au/gjm/emmix/emmix.html). This software has proved to be successful to solve the stellar membership problem of several galactic clusters once outliers have been pruned (Uribe et al., Statistical Chalenges in Modern Astronomy III, New York, Springer-Verlag, 2002).

The fact that we do not know to which component each star belongs leads to an incomplete data problem and allows the use of the EM algorithm to find estimates of the parameters of the mixture density. This procedure requires to find the maximum likelihood functions L and L_c, respectively, for the incomplete and the complete data problem. Then, considering $log(L_c)$, and following the expectation and maximization steps, a maximum value of L is found at the parameters vector Ψ^* (McLachlan et al., 2000). To reach a solution requires an iterative proccess and a starting vector of parameters that the software may construct automatically.

The found solution is given by:

$$\Psi^* = (\pi_f, \mu_{xc}, \mu_{yc}, \mu_{xf}, \mu_{yf}, \sigma_{xc}, \sigma_{yc}, \sigma_{xf}, \sigma_{yf}, \rho_c, \rho_f,)$$

=(0.451, -0.0809, 0.1951, -0.0621, -0.1190, 0.1012, 0.2353, 0.3902, 0.4659,-0.0289,-0.0825); where: π_f is the proportion of cluster stars; μ_{xc}, μ_{yc} the centroid of the cluster proper motions; μ_{xf}, μ_{yf} the centroid of the field proper motions; $\sigma_{xc}, \sigma_{yc}, \sigma_{xf}, \sigma_{yf},$ the x and y cluster and field dispersions and ρ_c, ρ_f the cluster and the field correlation coefficients. From the list of the stars with proper motions published by Marschall, Van Altena & Chiu (1982), according to the obtained membership probabilities, 103 stars are considered as physical members of the cluster NGC 2244.

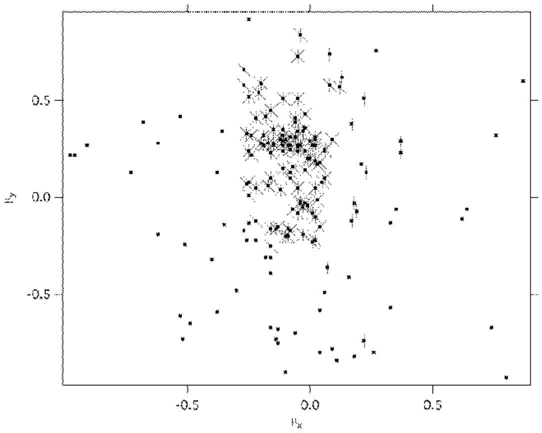

Fig. 1. VPD of the proper motions of 166 stars in the region of NGC2244 (dots). The 103 members found with EMMIX, (\) are compared graphically with the 92 found in a previous work by Sabogal et al., 2001 (/) and with 109 members in Marschall et al., 1982, (|).

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