THE SPATIAL DISTRIBUTION OF YOUNG OBJECTS IN THE LARGE MAGELLANIC CLOUD - A PROBLEM OF PATTERN RECOGNITION

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Methods used in pattern recognition and cluster analysis are applied to investigate the spatial distribution of OB associations and emission regions in the LMC. For our analysis we used the catalogue of associations of Lucke and Hodge (1970) and the catalogue of emission regions of Davies et al. (1976).

Several clustering algorithms (Anderberg 1973) were applied to the two-dimensional distribution of the young objects. The linkage in circle clustering method (Fig. 1 and 2) shows the conectedness of the objects at a given scale length. All objects are linked with center to center distances less than a given distance, i.e. the radius of a circle around an object. Fig. 3 and 4 show the dependence of the mean number of cluster members divided by the total number of objects versus the linkage circle. It reminds of a phase transition curve defined by a critical distance for clustering. The slope of the curve is a measure for order in the system. The hierarchical clustering method leads to three orders of clustering for both associations and emission regions (Fig. 5 and 6). A comparison with the distribution of OB and WR stars and the UV emission (see Fig. 4a, Martin et al. 1976) shows the one-to-one correspondence with the hierarchical clusters. In the same way the 2^{nd} and 3^{rd} order clusters coincide with the supergiant shells found by Meaburn (1980, 1981), see his Fig. 2.
The cluster analysis gives an objective procedure for a hierarchical partition of the system. The scales range from 0.06 deg at the 0^{th} order (the median diameter of associations and emission regions) to 8 deg for the whole system. A grand design structure of the system (spiral arms) should be visible in the last hierarchical order. The LMC as a late type galaxy shows no grand design. However, the spiral arm filaments being responsible for the flocculent appearances of spiral galaxies are identical with our intermediate scale structures found in the cluster analytic partition of the system. They are, too, identical with the spiral arm filaments described by Schmidt-Kaler (1977) and Feitzinger (1980).

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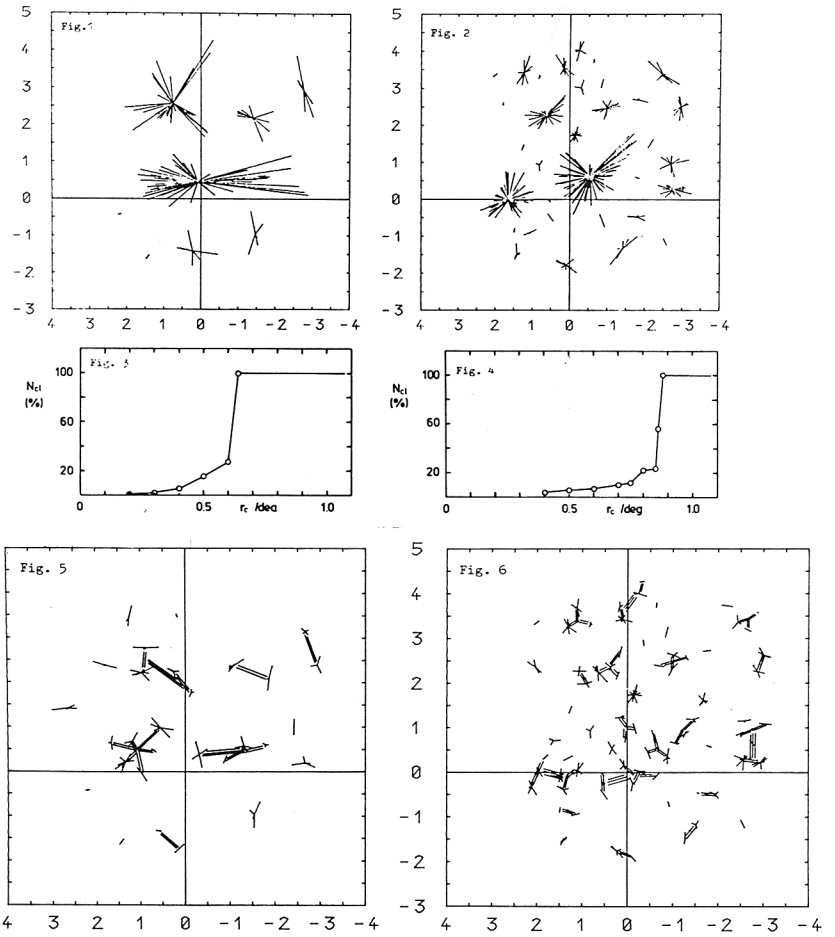

Fig. 1 Linkage in circle clusters of associations, r_c=0.666 deg.
Fig. 2 Linkage in circle clusters of emission regions, r_c=0.272 deg.
Fig. 3 Mean number of cluster members/total number of points versus circle radius/mean next neighbour distance for associations
Fig. 4 As Fig. 3 for emission regions
Fig. 5 Hierarchical clusters of associations; three orders are shown
Fig. 6 As Fig. 5 for emission regions

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