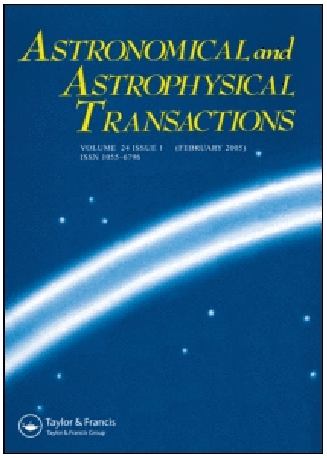

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SIZES AND AGES OF STAR FORMING REGIONS IN GALAXIES

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Results of a multicolor surface photometry of 71 star forming regions in the nine late type spiral and irregular galaxies are presented. The sizes and the colors of the star forming regions are studied. The ages of the star forming regions are estimated using evolutionary synthesis method. Two groups of galaxies are distinguished. Within the first group of galaxies, the star forming regions belonging to a given galaxy have approximately the same age. In the second group, both young (from *1Myrs*) and intermediate age (several *Gyrs*) star forming regions are observed. A correlation between the age and the size of star forming regions exists. A distribution of the star forming regions by size shows a maximum at 100–400 pc. It corresponds to stellar aggregations sizes (by Efremov) in hierarchical scale of star formation. A correlation between maximal diameters of the star forming regions and an absolute blue magnitude of a parental galaxy exists.

Keywords: Galaxies: spiral; Galaxies: late types, star formation, star forming regions

1 INTRODUCTION

In the last two decades the problem of star forming regions in galaxies has became very popular. Investigations of star forming regions, their sizes, ages and a disposition in galaxies are conducted in the both theoretical and observation aspects. Kennicutt (1988) and Elmegreen *et al*. (1996) found an existence of the dependence between galaxy blue absolute magnitude and a diameter of largest star forming regions. A hierarchical scale of star formation theory has been developed (Efremov, 1979; Elmegreen and Efremov, 1996). By this theory several scales of star formation in galaxies exist: stellar complexes (diameters are 800–1000 pc)—stellar aggregates (200–300 pc)—stellar associations (80–100 pc), and so on.

We are presenting an analysis of a multicolor photometry data of 71 star forming regions in the 9 late type spiral galaxies.

The description of the observations and the data reduction is presented in the separate JENAM-2000 publication (Gusev, 2001).

Ages of star forming regions were estimated by their positions on the two-color diagrams using PEGASE code (Fioc and Rocca-Volmerange, 1997) (Fig. 1). The radiation of neighbouring regions of a disk was subtracted from the radiation of a district occupated by a star forming region. The diameters of star forming regions were determinated as FWMH

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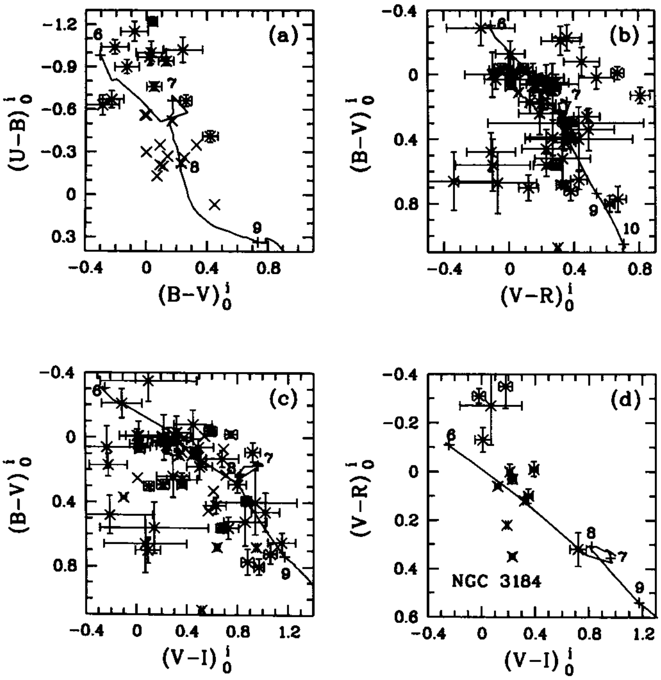

FIGURE 1 Two-colors diagram $(U-B)^i_0 - (B-V)^i_0$ (a), $(B-V)^i_0 - (V-R)^i_0$ (b), $(B-V)^i_0 - (V-I)^i_0$ (c) and $(V-R)^i_0$ $(V-I)^i_0$ (d) for the star forming regions in the galaxies. Solid curve is an evolutionary track of aging stellar system. Numbers indicate a logarithm of systems age in years.

for regions having a starlike profile, and as distance between points of a maximal light gradient for regions having diffuse profiles. The linear scale of a resolution of our observations is from 80 to 200 pc (Fig. 2a). The exception is NGC 5351 (500 pc).

A defect of photometrical determination of an age is the problem of determination of ages from 10 to 100 Myrs. There are no objects with age from 20 to 100 Myrs (Fig. 2c, 3b–d). We named this problem as the "teenager's problem". The cause of this problem is a existence of a evolution track loop on the two-color diagrams, and cluster with ages from 10 to 100 Myrs have the almost same positions.

2 RESULTS

We did not find a correlation between ages of the star forming regions and an absolute blue magnitude of a parental galaxy (Fig. 2b).

A correlation between ages and diameters of the star forming regions is not obvious. The average diameter of young star forming regions (225 ± 20 pc) is smaller than the average diameter of old ones (330 ± 40 pc) (although these values are very different from one galaxy to another; Fig. 2c). However, a small negative slope with dispertion exists for a correlation between ages and diameters of the star regions younger than 10 Myrs (Fig. 2d).

We studied the dependence between galaxy blue absolute magnitude and a diameter of largest star forming regions (Fig. 3a). Our result $\log D_{max} = -1.22\ (\pm 0.08) - 0.19\ (\pm 0.03)\ M_B$ is the same within errors as result by Elmegreen *et al.* (1996) for late types galaxies ($\log D_{max} = -1.47\ (\pm 1.72) - 0.22\ (\pm 0.09)\ M_B$).

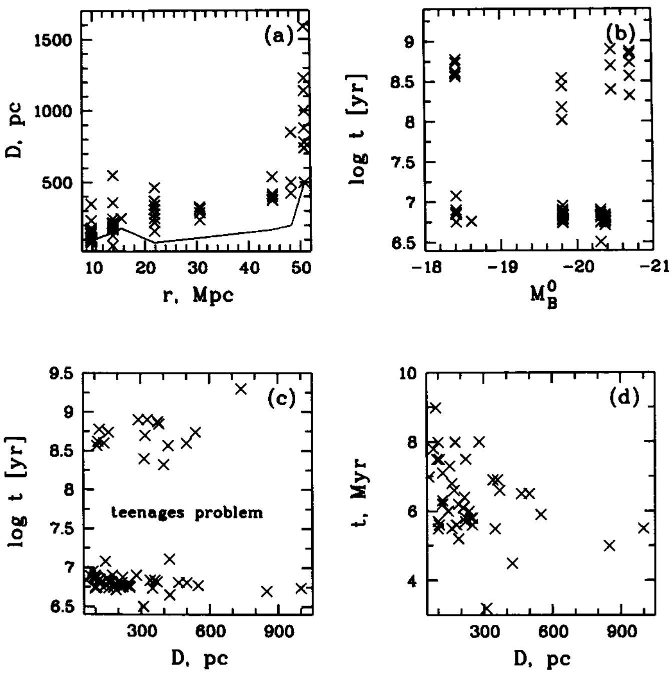

FIGURE 2 Diameters of the star forming regions *vs*. distance to a galaxy diagram (a); the solid a minimal diameter of observed star forming regions in pc for given galaxy (linear scale solution). A correlation between ages of the star forming regions and an absolute blue de of a parental galaxy (b). A correlation between ages and diameters of the star forming (c, d).

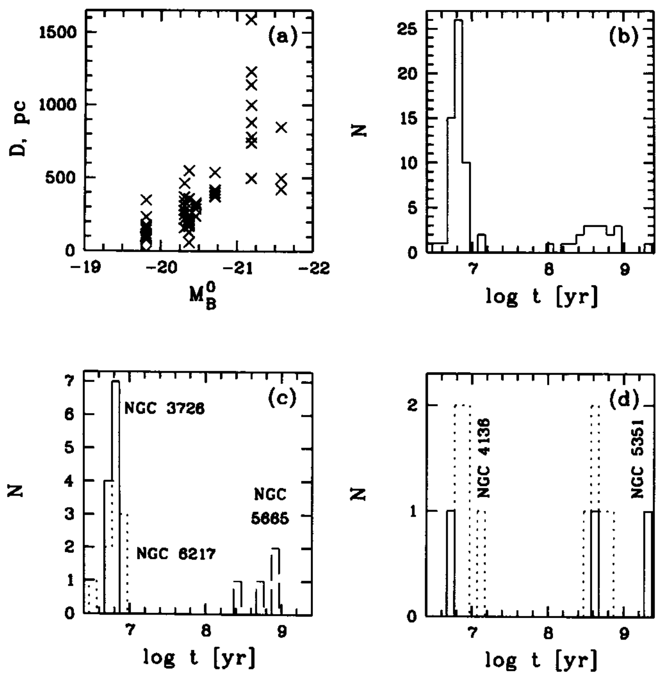

FIGURE 3 A correlation between diameters of the star forming regions and an absolute blue de of a parental galaxy (a). A distribution of the star forming regions by ages for all ated galaxies (b), and for the individual galaxies (c, d).

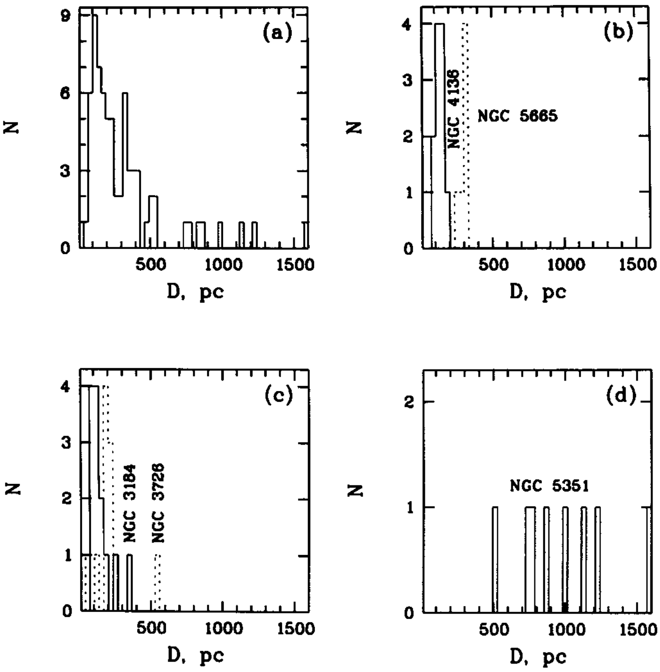

FIGURE 4 A distribution of the star forming regions by diameters for all investigated galaxies (a), and for the individual galaxies (b–d).

A distribution of the star forming regions by ages shows the galaxies can be divided into two groups. Within the first group of galaxies, the star forming regions belonging to a given galaxy have approximately the same age (Fig. 3c). In the second group, both young (from 1 Myrs) and intermediate age (several Gyrs) star forming regions are observed (Fig. 3d).

Most parts of the regions have diameters from 80 to 420 pc (Fig. 4). Two local maxima stand out on 120 pc and 330 pc. A local minimum between ones on 290 pc is a statistical effect, probably. Five star forming regions have a diameter 500 $\pm$ 50 pc. We did not find a single star forming region with diameter more than 550 pc.

Acknowledgement

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References

Efremov, Yu. N. (1988) *Sov. Astron. Let.* **5**, 12.
Elmegreen, B. G., and Efremov, Yu. N. (1996) *Astrophys. J.* **466**, 802.
Elmegreen, B. G., and Elmegreen, D. M., Salzer J. J., Mann, H. (1996) *Astrophys. J.* **467**, 579.
Fioc, M., Rocca-Volmerange, B. (1997) *Astron. Astrophys.* **326**, 950.
Gusev, A. S. (2001) *Astron. Astrophys. Trans.* **20**, 169.
Kennicutt, Jr., R. C. (1988) *Astrophys. J.* **334**, 144.