4. CONCLUSIONS

In conclusion, the present analysis reveals the following facts for the three Ic-type KUGs 1618+378, 1624+404, and 1626+413 and the clumpy irregular galaxy Mrk 297:
(1) These galaxies contain several to more than ten bright blue clumps which are scattered out to the peripheral regions.
(2) The excitation mechanisms of these clumps are similar to galactic H II regions, but the scales and brightnesses are much larger.
(3) KUG 1626+413 probably belongs to the clumpy irregular type, and the two other KUGs may be spiral galaxies much perturbated by active star formation. Mrk 297 is confirmed as an active starburst galaxy.
(4) From the FIR fluxes, they have a star formation rate 3 to 10 times larger than the starburst galaxy M82.

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NUMERICAL SIMULATIONS OF STAR FORMATION BURSTS INDUCED BY THE GALAXY-GALAXY INTERACTION

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The galaxy-galaxy interaction has been proposed as a possible triggering mechanism of the star formation bursts in some galaxies (e.g. Larson and Tinsley 1978). To investigate the nature of star formation bursts triggered by interaction we have numerically simulated close encounters between disk galaxies, taking the star formation process into account (see Noguchi and Ishibashi 1986 for details). We used the cloud-particle model, in which gas clouds move as test particles in the gravitational field of the galaxies. When two clouds collide with each other, an OB-star is formed. The cloud system loses its kinetic energy by inelastic cloud-cloud collisions. The supernova explosion which follows the formation of an OB-star provides kinetic energy to the nearby clouds.

Prior to the encounter simulation, an equilibrium model of a disk galaxy (with a mass = 1.8×10^{11} $M_{\odot}$ and a radius = 20 kpc) is made in which the star formation rate (SFR, i.e. the number of OB-stars formed in each time step) is nearly constant. This model represents an isolated

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galaxy. In the encounter model, a point-mass perturber passes by this equilibrium galaxy and disturbs it gravitationally. When the cloud system is disturbed, the cloud-cloud collisions generally become more frequent, leading to the enhancement of the SFR.

1. RESULTS

1) In the typical model (the parabolic passage of the equal-mass perturber with a perigalactic distance of 40 kpc), the SFR rises to a maximum value, $\sim$ 10 times as large as the pre-encounter value, $\sim 10^8$ yr after the perigalactic passage (Figure 1).
2) OB-stars are formed preferentially in the two-armed spiral structure of the cloud system induced by the tidal interaction (representative snapshots are given in Figure 2).

2. DISCUSSION

The model results explain fairly well the color anomalies of interacting galaxies. These galaxies show large scattering in the two-color diagram (filled circles in Figure 3). The model galaxy also shows anomalous variation of colors as the SFR abruptly rises to its maximum value and declines afterwards. The evolutionary tracks of the typical model cal-

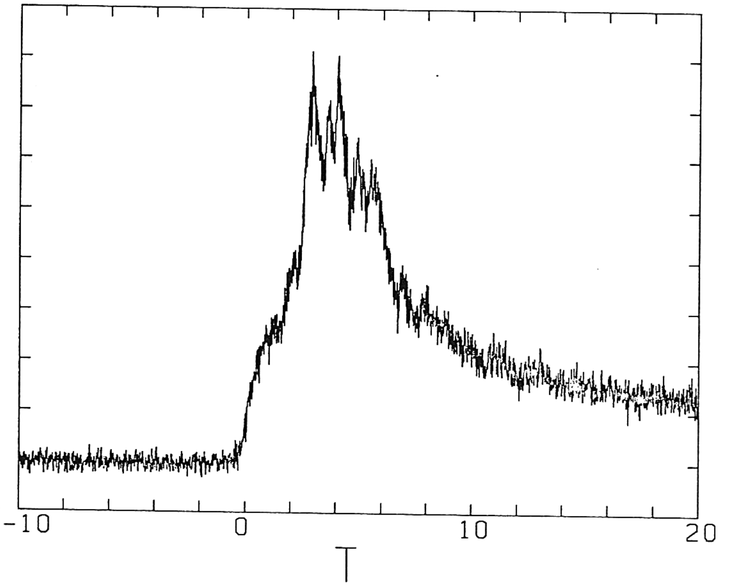

Fig. 1. Time variation of the star formation rate in the typical model. Time is given in units of 10^8 yr and T = 0 corresponds to the perigalactic passage.

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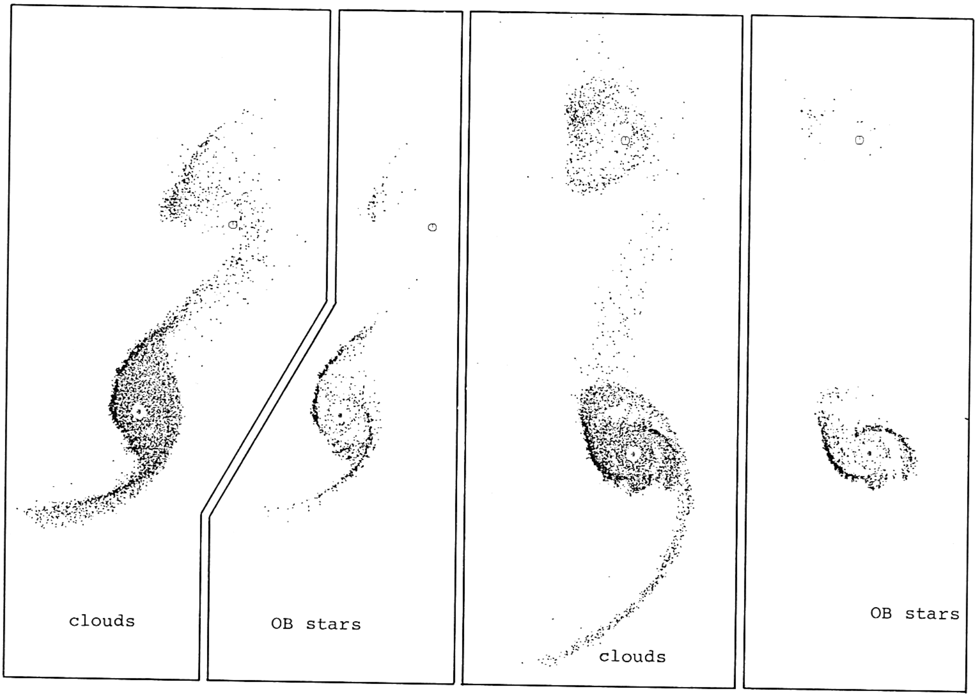

Fig.2. Distribution of clouds and OB-stars (left; T = 2, right; T = 4).

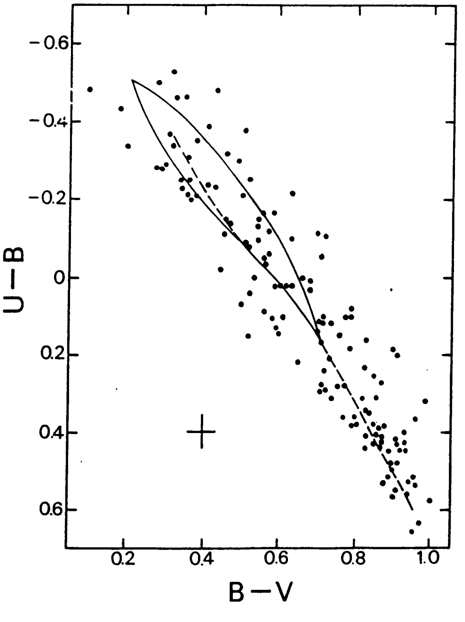

Fig. 3. Comparison with the colors of interacting galaxies in the Arp Atlas.

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culated based on the variation of the SFR shown in Figure 1 fill the region enclosed by the solid line in Figure 3.

As for the spatial distribution of star forming regions, nuclear starbursts are often reported observationally. On the other hand, in our models the outer part of the disk is activated more efficiently (Figure 2). A more realistic simulation is needed to find out whether other factors neglected in our model are important in solving this discrepancy.

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CO OBSERVATIONS OF BRIGHT IRAS GALAXIES

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CO emission has been detected from 75 bright infrared galaxies with CZ = 2 000 - 16 000 km/s. These include the most distant and the most luminous galaxies (Arp 55, IR 1713+63) yet detected in CO. All of these galaxies are rich in molecular gas with $M_{total}(H_2) = 2\times10^9 - 6\times10^{10} M_\odot$, and they have a strong far-infrared excess, with L_{FIR}/L_B = 2-40 and $L_{FIR}(40\text{-}400\mu) = 10^{10} - 3\times10^{12}\ L_\odot$. The primary luminosity source appears to be star formation in molecular clouds. A strong correlation is found between the FIR and 21-cm continuum flux, implying that the IMF is independent of the star formation rate. The ratio $L_{FIR}/M(H_2)$ provides a measure of the current rate of star-formation, which is found to be a factor 3-20 larger in these galaxies than for the ensemble of molecular clouds in the Milky Way. VLA maps plus a few high resolution (14"-30") CO (1-0) and CO (2-1) maps suggest that most of the luminosity comes from core regions 1-3 kpc in size. The abnormal concentration of molecular gas in these galactic cores is presumably the result of a collision or strong interaction with a nearby companion.

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