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ON THE ORIGIN AND EVOLUTION OF PAIRS OF GALAXIES THAT HAVE DIFFERENT PHYSICAL AND KINEMATIC CHARACTERISTICS

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We have gathered data on U,B,V,K magnitudes, radial velocities, spectra, morphological types, radio-emission, dimensions and other characteristics for 47 pairs of galaxies (Metik and Pronik 1978). The following results were obtained:

1. Colour indices of members of pairs are given in figure 1. It shows that the pairs divide into three separate sequences. Red galaxies with (U-B) > + $0^m.5$ co-exist with galaxies of any colour, whereas blue galaxies co-exist only with blue or very red ones. Moreover in the pairs of mixed colour the smaller the colour index of the blue galaxy the redder is its component. Pairs of blue galaxies form a separate group (sequence I). Both members of this sequence have either negative or small positive colour indices (U-B). The rest of the pairs of galaxies form sequences II and III. They lie along two lines corresponding to (U-B) $\sim$ + $0^m.5$. Such colour index belongs to the brighter component (subscript 1) of the pairs of sequence II and to the fainter one (subscript 2) of sequence III. Members of pairs change their colours along each sequence: in I - both members, in II - the fainter component, in III - the brighter one.

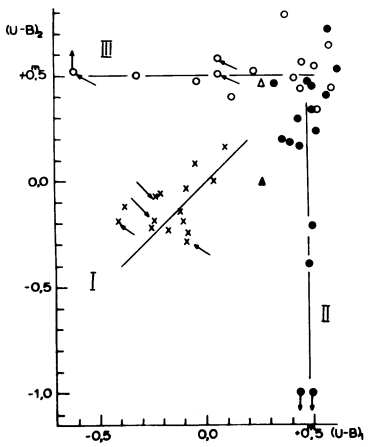

Figure 1. Correlation of colour indices of members of pairs. Crosses - pairs of sequence I, dots - II, and circles - III.

2. Sequences of pairs selected according to their colours show also differences in radial velocities (V_r). Pairs of sequences I and II have on average smaller differences in radial velocities than those of sequence III. Moreover sequences II and III show a dependence of $\lg|\Delta V_r|$ on $\Delta|(U-B)|$: $\lg|\Delta V_r|$ decreases with decreasing $\Delta|(U-B)|$ in sequence II whereas in sequence III we have the opposite case.

https://doi.org/10.1017/S0074180900144341 Published online by Cambridge University Press

3. Members of sequence I are spiral or irregular galaxies. Ep, Seyfert and Markarian galaxies are also present. There are E-E and E-S pairs in sequence II and no Markarian and Seyfert galaxies. E-E and S-E pairs are present in sequence III; Markarian and Seyfert galaxies are also present.

4. Absolute magnitudes and spectral types. There is a connection between these characteristics, but different for each sequence. The brighter members of the pairs of sequences I and II have more later spectra whereas III sequence have earlier ones.

5. Infrared data at 2.2μm. (V-K) colours for 10 galaxies of sequence II and for 10 galaxies of sequence III are available. On average galaxies of sequence II are redder than those of sequence III. If confirmed, this means that the former on average are more "metallic" than the latter.

6. We did not find differences in the radio luminosities of the members belonging to the I, II and III sequences.

7. The dimensions of the pairs are in good agreement with the data of Karachentsev (1970): pairs of spiral galaxies have larger sizes than those of mixed ones.

8. The origin and evolution of pairs of galaxies were considered by Heidman (1976). He pointed out two main phenomena: both galaxies of the pair were born at the same time or the smaller component is the result of ejection activity of the main one. The character of the $\lg|\Delta V_r|$ and $\Delta(U-B)$ relation for sequences II and III shows that the velocities and colours of fainter pairs are not accidental. The ejection origin of the fainter component cannot ensure this. If this result is supported by future observations it will mean that members of pairs of galaxies were born at the same time.

9. The data suggest that the sequences I, II and III are different in their origin and evolution. The three sequences of pairs show differences in morphology and velocities too. It is well known that kinematical properties of systems of galaxies are formed before the time of star formation. This suggests that sequences I, II and III separated before the matter began to condense into galaxies. The members of these sequences had different primary conditions of formation and so evolved in different ways. Main galaxies of pairs of sequence II with high M_B have later spectral types than those of sequence III. We conclude that the latter contain more massive stars than the former.

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https://doi.org/10.1017/S0074180900144341 Published online by Cambridge University Press