

## ON THE TIDAL ORIGIN OF M51-TYPE SYSTEMS

B. Vorontsov-Velyaminov

We established M51 systems as a class of interacting pairs of galaxies in 1959. In 1975 I showed that among 160 systems with this appearance the ratio of luminosities (and hence masses) of the components varies from 1:1 to 1:0.01. In the latter case, the companion is comparable in mass and dimension to an isolated H II region. The number of such M51-type systems increases as the luminosity of the companion decreases. Small companions cannot draw spiral arms from the primary companions by means of tides. Yet, they are observed at the tips of spiral arms. Thus, they must originate at the same time as the spiral or form within them. In some cases, these companions emanate from the spiral arm, as is shown by comparison of observations and calculations.

There are cases, such as VV 20, 21, 244, 247 and others, in which the components have bridges or tails, possibly of tidal origin, much fainter than the original spiral arms. They form large angles with real spiral arms and probably lie in another plane.

There are some "twice M51-type" galaxies with two similar components at the ends of opposite arms. It is impossible to believe that this resulted from their simultaneous arrival from infinity or from very elongated closed orbits to symmetrical, very close positions relative to the primary. In VV 470 the relative dimensions of the components are equal to those in the case of M51.

It is noteworthy that there are cases (M51, VV 19, VV 20 and others) where, besides a curved filament, really or only apparently connecting the components, there is also a straight and more massive filament connecting them which is not predicted by the tidal theory.

The fine tidal arms ingeniously obtained by this theory disappear in a more realistic treatment in which there is self-gravitation and small dispersion of velocities (modelled by F. Hohl). The hypotheses of collisions to explain ring galaxies and "Mergers" fails on the grounds of statistics and because of the existence of tight nests of galaxies.

THE FREQUENCY OF RING GALAXIES AND THE PROBABILITY  
OF THEIR FORMATION BY COLLISIONS

V. Dostal and V. Metlov

A survey of ring galaxies which were discovered in 1960 by B. Vorontsov-Velyaminov has been carried out using the Morphological Catalogue of Galaxies. Clusters of galaxies were also included. Such galaxies without spiral arms constitute 0.7% of all galaxies down to  $15^m$ , and are 100 times less frequent than spiral galaxies. This percentage is the same for clusters, but there are fields where ring