

Interaction Between NGC 5394 and NGC 5395

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1. Introduction

The spiral galaxies NGC 5394/95 (at a distance of 47 Mpc) are involved in a recent, close, nonmerging encounter. The smaller galaxy, NGC 5394, has two long, fairly symmetric, open tidal arms (see Figure 1); in numerical simulations, this type of structure results from a close, prograde, nearly in-plane encounter. To study this galaxy pair, we used the VLA to obtain HI (21 cm line) and radio continuum data, the Maryland-Caltech Fabry-Perot camera to obtain H α data, the 2.1 m telescope at KPNO, the Fick observatory 0.6 m telescope, and the Burrell-Schmidt telescope to take optical and near-infrared images, and Onsala Space Observatory for CO $J = 1 - 0$ observations.

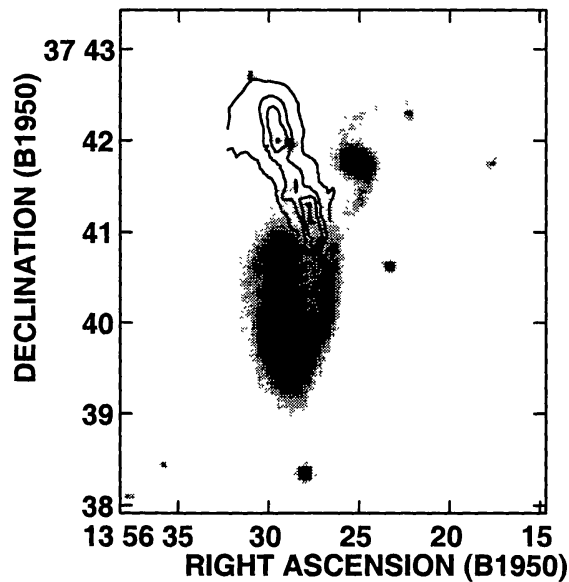


Figure 1. Digitized Sky Survey image of NGC 5395 (left) and NGC 5394 (right) overlaid with N(HI) contours of the long, narrow HI tidal arm of NGC 5395 that is distinct in velocity from its main disk.

2. Results

We find there are three important, kinematically-separate, components to the HI emission from this pair: (1) the main disk of NGC 5395, (2) a long, narrow tidal arm of NGC 5395 distinct in velocity from its main disk, and (3) the disk of NGC 5394. The HI tidal arm of NGC 5395 (displayed as contours in Figure 1) has a line-of-sight velocity as much as 75 – 100 km/s greater than that of the main disk at the same projected location and thus is not in the same plane as the disk. The dominant spiral arm of NGC 5395 forms a large ring or pseudo-ring of H α , radio continuum, and HI emission, somewhat off-centered with respect to the nucleus. The eastern side of the ring is brighter in radio continuum and H α emission, whereas the western side is brighter in HI, with massive HI clouds ($10^8 M_{\odot}$). The velocity field of the disk of NGC 5395 is asymmetric and distorted by large-scale and small-scale noncircular motions. There are prominent kinks in the H α velocity contours crossing the ring and crossing a very large shell or caustic feature.

NGC 5394 has a central starburst, very bright inner spiral arms, and two long, fairly symmetric, open tidal arms that are disjoint from the inner spiral arms. The stellar arm/interarm contrast of the tidal arms is large compared to that of normal spiral arms. Only one of the three inner spiral arms is clearly detected in H α emission.

A preliminary numerical model for the encounter reproduces a number of these features with a collision that is prograde relative to NGC 5394 and retrograde at a high tilt angle relative to the disk of NGC 5395. In particular, the model finds that the inner spiral structure of NGC 5394 developed from ocular structure at slightly earlier times.