ABSTRACT

The simulation of accretion during galactic mergers

The merger hypothesis suggests that elliptical galaxies are formed by the merging of two spiral galaxies each having a central massive black hole. The black holes would therefore be expected to form a high angular momentum binary pair. The accretion of gas onto the rapidly spinning binary could account for the radio emissions in elliptical galaxies and explain why only ellipticals are observed as radio-loud active galactic nuclei (AGN's). Our objective was to test this hypothesis.

Using the TREESPH program developed by Hernquist and Katz, we did self-consistent numerical experiments to investigate the merging of galaxies and the accretion of gas onto the black holes. We used a very realistic model of a stable spiral galaxy with a large mass at the centre representing the black hole. Different initial galactic orientations and alignments were tested.

In general we observed that, depending on the initial orientation of the galaxies, different quantities of the gas were lost to the intergalactic regions, but in all cases a large amount fell to the centre of the remnant. Surprisingly, a black hole binary was not readily formed in any of the merger simulations. Rather, the black holes followed the centres of their respective nuclei during the merger. The internal regions of the galaxies did not readily loss their angular momentum and therefore coalescing occurred very slowly. The amount of accretion which occurred during the last stages of the merger could

sustain AGN activity only for very short periods compared to the age of the galaxy. The gas which remained dispersed throughout the merger remnant could explain the disparity between the globular cluster content of ellipticals and spirals.

Keywords:

Galactic Mergers, Active Galactic Nuclei, Formation of Elliptical Galaxies