The Generation of Hot Galactic Halos: Multi-Phase Simulations including Collision-Induced Shock Heating, and Comparisons with Observations

Nathan C. Hearn, Susan A. Lamb (*Center for Theoretical Astrophysics, Department of Physics and Department of Astronomy, University of Illinois, 1110 West Green Street, Urbana, IL 61801, USA*)

Abstract

The presence of hot halos around some colliding and supposed merging galaxies, as detected in X-rays, suggests that galaxy interactions may be responsible for the production of significant amounts of hot-phase interstellar gas in some systems. Possible mechanisms for producing this hot material are large-scale shock heating due to the collision itself, as well as the subsequent supernova explosions and intense stellar winds from the massive stars that are formed in collision-induced starbursts. We are using numerical simulations of galaxy collisions and mergers to explore the possible contribution of these various physical mechanisms. These simulations are compared with observations of real systems. Here we report on results from the application of a new N-body/smoothed particle hydrodynamics simulation code that has been constructed to allow the representation of multiple phases in the interstellar medium (Hearn et al, in preparation). This simulation code has been used to explore the generation of hot interstellar gas due to the large-scale shock heating that occurs during the collision and merger of two gas-rich disk galaxies. This current study allows us to place limits on the effect of the collision itself (as opposed to the results of subsequent star formation) on the generation of hot halos. We compare our numerical results to the extensive observations of the collisional merging system Arp 220 and, in particular, with our recent Chandra observations of its extended X-ray halo (McDowell et al, in preparation).

CATEGORY: CLUSTERS OF GALAXIES