The milky way and andromeda galaxies

ASSIGN BUSTER

The optical morphology of galaxies varies according to environment. In a rich cluster, galaxies will usually be elliptical, S0 and cD galaxies. In lower density regions irregular and spiral galaxies are more commonly found. Such low density regions include near the edges of galaxy clusters, in groups, on the outer edges of rich clusters, or as a relatively isolated galaxy. Examples of irregular galaxies that follow this pattern include those in the Local Group (e. g. NGC3109, Sextans A and B) and the irregular galaxies that can be found on the outskirts of the Virgo Cluster.

In high density regions there is the likelihood of more interactions that could lead to alterations in morphology, for example galaxy-galaxy and galaxy-cluster interactions. These types of interactions could explain why there are fewer spiral galaxies in high density regions. The merging of two spiral galaxies of similar size is thought to result in the formation of an elliptical galaxy. Spiral galaxies that fall into the intracluster medium are thought to lose a significant proportion of their interstellar medium due to the effects of ram pressure stripping, resulting in a S0 or dwarf spheroidal galaxy. In the centre of a rich galaxy cluster it is common to find a luminous elliptical galaxy (such as M87 in the Virgo cluster), these are likely to have formed from the merger of several smaller galaxies and in some cases can result in the formation of a cD galaxy. An example of the morphological distribution of galaxies in a rich cluster can be seen in the Virgo cluster which has the cD galaxy M87 at its centre and a high proportion of elliptical and S0 galaxies surrounding M87.

The impact that environment has on dwarf galaxies is not so well known since these galaxies are fainter and thus more difficult to observe.

1b)The luminosity of galaxies also varies with optical morphology. On average spiral and irregular galaxies are brighter than ellipticals or S0 galaxies of a similar mass. Spiral and irregular galaxies have a higher content of very young stars whereas S0 and elliptical galaxies contain older, less bright stars. However, since galaxies can vary significantly in size then the luminosity needs to be looked at over a range of galaxy types and sizes. Elliptical galaxies exhibit the widest variation in size and luminosity. The luminosity of ellipticals can be in the range 3×10^{5} to 10^{11} L_{sun} and this is due to them ranging in size from extreme dwarfs to cD galaxies. A dwarf elliptical such as M32 has a luminosity of 1.995×10^{9} L_{sun} (source: Grebel, 2003) and a cD galaxy such as NGC 6166 has a luminosity of 3.7×10^{11} L_{sun} (source: Bender, 2015). There is less variation in size for spiral galaxies and they can only be found as large or giant systems, consequently spiral galaxies have luminosities over the range 10^{8} to 2×10^{10} L_{sun} . A typical spiral galaxy such as the Milky Way has a luminosity of 2.5×10^{10} L_{sun} (source: Grebel, 2003) . Irregular galaxies have luminosities in the range 10^{7} to 10^{9} L_{sun} and therefore are not as bright as some of the giant spirals. In the Local Group there are dwarf irregular galaxies such as NGC 6822 which has a luminosity of 9.4×10^{7} L_{sun} and larger irregular galaxies such as the Large Magellanic Cloud which has a luminosity of 2.5×10^{10} L_{sun} (source: Grebel, 2003).

. The Milky Way and Andromeda are due to merge with each other in approximately 2 billion years. As the two galaxies get closer the biggest changes will be caused by the gravitational effects of the two galaxies and the friction caused between the gas and dust. These early effects will result in the shape of the galaxies being altered when stars are forced out of their orbits. Ultimately, how both galaxies are affected by the merger process will be dependent on the collision angle, speed of the galaxies, their size and composition. Material from the outer disks of both galaxies will be stripped off and form tidal tails. During the merger process the orbits of the stars will become random and have little order. It is unlikely that any stars will collide with each other as they are so far apart. However, some stars will be ejected from the final galaxy.

As the galaxies collide clouds of hydrogen gas will accumulate and be compressed enough to trigger gravitational collapse and thus begin the star formation process.

During the merger process the dark matter is unlikely to interact and will remain unchanged.

The Sun will be moved from its present orbit and is likely to end up in the outer halo of the newly formed galaxy at a radius > 30kpc as part of an extended tidal tail. There is also the small possibility that the Sun could be ejected from the galaxy altogether.

As the two black holes at the centre of each galaxy approach within 1 light year of each other they will begin to emit gravitational waves. This energy will radiate out, affecting the orbits of stars. It is possible that the gas accumulated by the black hole merger could create a luminous quasar or an active galactic nucleus in the centre of the newly formed galaxy.

Since the Milky Way and Andromeda galaxies are similar in size, then their spiral structures will be destroyed during the collision and the new single larger system will result in a giant elliptical galaxy.