

A PECULIAR GALACTIC CLASH

Galaxies are not static islands of stars -- they are dynamic and ever-changing, constantly on the move through the darkness of the Universe. Sometimes, as seen in this spectacular Hubble image of Arp 256, galaxies can collide in a crash of cosmic proportions.

Arp 256 is a stunning system of two spiral galaxies, about 350 million light-years away, in an early stage of merging. The image, taken with the NASA/ESA Hubble Space Telescope, displays two galaxies with strongly distorted shapes and an astonishing number of blue knots of star formation that look like exploding fireworks. The star formation was triggered by the close interaction between the two galaxies.

350 million light-years away in the constellation of Cetus (the Sea Monster), a pair of barred spiral galaxies have just begun a magnificent merger. This image suspends them in a single moment, freezing the chaotic spray of gas, dust and stars kicked up by the gravitational forces pulling the two galaxies together.

Though their nuclei are still separated by a large distance, the shapes of the galaxies in Arp 256 are impressively distorted. The galaxy in the upper part of the image contains very pronounced tidal tails -- long, extended ribbons of gas, dust and stars.

The galaxies are ablaze with dazzling regions of star formation: the bright blue fireworks are stellar nurseries, churning out hot infant stars. These vigorous bursts of new life are triggered by the massive gravitational interactions, which stir up interstellar gas and dust out of which stars are born.

Arp 256 was first catalogued by **Halton Arp** in 1966, as one of 338 galaxies presented in the aptly-named **Atlas of Peculiar Galaxies**. The goal of the catalogue was to image examples of the weird and wonderful structures found among nearby galaxies, to provide snapshots of different stages of galactic evolution. **These peculiar galaxies are like a natural experiment played out on a cosmic scale and by cataloguing them, astronomers can better understand the physical processes that warp spiral and elliptical galaxies into new shapes.**

Many galaxies in this catalogue are dwarf galaxies with indistinct structures, or active galaxies generating powerful jets -- but a large number of the galaxies are interacting, such as Messier 51, the Antennae Galaxies, and Arp 256. Such interactions often form streamer-like tidal tails as seen in Arp 256, as well as bridges of gas, dust and stars between the galaxies.

Long ago, when our expanding Universe was much smaller, interactions and mergers were more common; in fact, they are thought to drive galactic evolution to this day. The galaxies in the Arp 256 system will continue their gravitational dance over the next millions of years, at first flirtatious, and then intimate, before finally morphing into a single galaxy.

Merging galaxies in the distant Universe through a gravitational magnifying glass.

Colliding galaxies are common during galaxy evolution. The extremely tenuous distribution of matter in galaxies means these are not collisions in the traditional sense of the word, but rather gravitational interactions.

Colliding may lead to merging if two galaxies collide and do not have enough momentum to continue travelling after the collision. In that case, they fall back into each other and eventually merge into one galaxy after many passes through each other. If one of the colliding galaxies is much larger than the other, it will remain largely intact after the merger. The larger galaxy will look much the same, while the smaller galaxy will be stripped apart and become part of the larger galaxy. When galaxies pass through each other, unlike during mergers, they largely retain their material and shape after the pass. Galactic collisions are now frequently simulated on computers, which use realistic physics principles, including the simulation of gravitational forces, gas dissipation phenomena, star formation, and feedback. Dynamical friction slows the relative motion galaxy pairs, which may possibly merge at some point, according to the initial relative energy of the orbits.

Astronomers estimate the Milky Way galaxy will collide with the Andromeda galaxy in about 4.5 billion years and merge to become an elliptical galaxy.



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