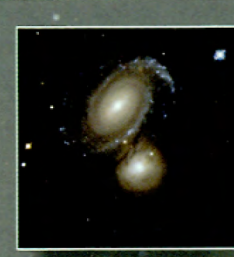
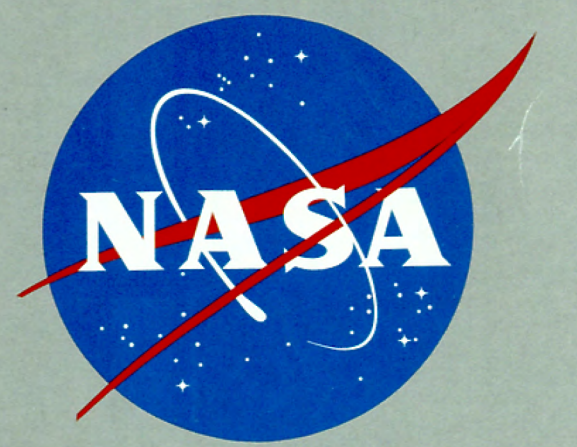




**Hubble** 2008  
Science Year in Review



AM 0500-620 consists of a highly symmetric spiral galaxy seen nearly face-on and a background galaxy that partially backlights it. AM 0500-620 has a number of dust lanes between its arms. The background galaxy, but *Hubble* has now revealed a galaxy with dusty spiral arms and bright knots of stars. AM0500-620 is 350 million light-years away from Earth in the constellation of Dorado, the Swordfish.



ESO 77-14 is a celestial merger of two similar sized galaxies. Two clear signatures of the gravitational tug of war between the galaxies are the bridge of material that connects them and the disruption of their main bodies. The galaxy on the right has a long, bluish arm, while its companion has a shorter, redder arm. The dust lanes between the two galaxy centers show the extent of the distortion to the pair's originally flat disks. This interacting pair is in the constellation of Indus, the Indian, some 550 million light-years away from Earth.



Arp 148 is the aftermath of a staggering encounter between two galaxies, resulting in a ring-shaped galaxy and a long-tailed companion. The collision between the two galaxies produced a shockwave effect that first drew matter into the center and then caused it to propagate outwards in a ring. Infrared observations of the elongated companion perpendicular to the ring, reveal a strong obscuration region that appears as a dark dust lane across the nucleus in optical light. Arp 148 is located in the constellation of Ursa Major, the Great Bear, approximately 500 million light-years away.



ESO 550-2 consists of a pair of spiral galaxies, a larger one (nearly face-on) accompanied by a smaller, highly tilted partner. Tidal interaction from the smaller companion has clearly deformed one arm of the larger galaxy. Strong star formation continues both in the deformed arm and in a ring structure around the galaxy's core. The pair is surrounded by the glow of faintly shining stars and interstellar matter that has been distributed through space by the gravitational effects of the collision and pull of a third nearby galaxy. ESO 550-2 is located 400 million light-years away in the constellation of Eridanus, the River.



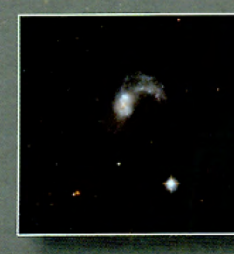
NGC 6050/IC 1179 (Arp 272) is a tremendous collision between two spiral galaxies, NGC 6050 and IC 1179. It is part of the Hercules Galaxy Cluster, located in the Spring constellation of Hercules. The galaxy cluster is part of the Great Wall of clusters and superclusters, the largest known structure in the universe. The two spiral galaxies are linked by their swirling arms. Arp 272 is located some 450 million light-years away from Earth.



CGCG 436-030, the spiral galaxy in the upper left of the image, displays a very pronounced curling tail. The companion galaxy, located to the bottom-right of the image, displays an intricate structure, including a number of trails that extend quite far out from its core. The bright star that appears between the two galaxies does not belong to the interacting system, but lies within our own galaxy. CGCG 436-030 is located in the constellation of Pisces, the Fish, about 400 million light-years away.



ESO 593-8 is a pair of interacting galaxies with a feather-like galaxy crossing a companion galaxy. In the future, the two cores of the parent galaxies will probably merge to form a single galaxy. The pair contains a number of bright blue star clusters. ESO 593-8 is located in the constellation of Sagittarius, the Archer, some 650 million light-years away from Earth.



IC 2545 is a deceptive object that appears to be a single S-shaped galaxy, but is actually a pair of merging galaxies. The two cores of the parent galaxies are still visible in the central region. Other telltale markers of the collision include two pronounced tidal arms of gas and stars flung out from the central region. The tidal arm curving upwards and clockwise in the image contains a number of blue star clusters. IC 2545 glows strongly in the infrared part of the spectrum—another sign that it is a pair of merging galaxies. It lies in the southern constellation of Antlia, the Air Pump, some 450 million light-years away from Earth.



Arp 299 consists of a pair of galaxies cataloged as IC 694 and NGC 3690, which made a close pass some 700 million years ago. As a result of their interaction, the system underwent an intense burst of star formation. Over the last 15 years, 6 supernovas have exploded in the outer reaches of the galaxy, making this system a prolific supernova factory. Arp 299 belongs to the family of ultra-luminous infrared galaxies, yet is marked by excess ultraviolet emission as well. It is located in the constellation of Ursa Major, the Great Bear, approximately 150 million light-years away.



Markarian 273 is a galaxy with a peculiar structure that includes an intricate central region and a prominent tail that extends diagonally towards the bottom-right of the image. The tail is about 130,000 light-years long and is strongly indicative of a merger between two galaxies. Markarian 273 has an intense region of starburst, where 60 solar masses of new stars are born each year. Near-infrared observations reveal a nucleus with two components. Markarian 273 is one of the most luminous galaxies when observed in the infrared, and is located 500 million light-years away from Earth in the constellation of Ursa Major, the Great Bear.



NGC 7674 (seen just above the center) is the brightest and largest member of the so-called Hickson 96 compact group of four galaxies. Its central bar-like structure is made up of stars. The overall shape of NGC 7674, including the long narrow streamers seen to the left of and below the galaxy, can be accounted for by tidal interactions with its companions. NGC 7674 has a powerful, active, nucleus that is likely fed by gas from the system. It is located in the constellation of Pegasus, the Winged Horse, about 400 million light-years away from Earth.



NGC 454 is a galaxy pair composed of a large red elliptical galaxy and an irregular gas-rich blue galaxy. The system is in the early stages of an interaction that has severely distorted both components. The three bright blue knots of very young stars to the right of the two main components are probably part of the irregular blue galaxy. Although the dust lanes that stretch all the way to the center of the elliptical galaxy suggest that gas has penetrated that far, no signs of star formation or nuclear activity are visible. The pair is approximately 164 million light-years away in the constellation of Phoenix.



UGC 9618, also known as VV 340 or Arp 302, consists of a pair of very gas-rich spiral galaxies in the early stages of interaction. VV 340A is seen edge-on to the bottom-left, and VV 340B face-on to the upper-right. An enormous amount of infrared light is radiated by the gas from massive stars that are forming at a rate similar to that of the most vigorous giant star-forming regions in our own Milky Way. UGC 9618 is 450 million light-years away from Earth in the constellation of Bootes, the Herdsman.



NGC 520 is the product of a collision between two disk galaxies that started 300 million years ago. It exemplifies the middle stage of the merging process: the disks of the parent galaxies have merged together, but the nuclei have not yet coalesced. It features an odd-looking tail of stars and a prominent dust lane that runs diagonally across the center of the image and obscures the galaxy. NGC 520 is one of the brightest galaxy pairs in the sky, and can be observed with a small telescope, having the appearance of a comet. It is located in the constellation of Pisces, the Fish, and is about 100 million light-years away.



Arp 240 is an astonishing galaxy pair, composed of spiral galaxies of similar mass and size, NGC 5257 and NGC 5258. The galaxies are visibly interacting with each other via a connecting bridge of dim stars. Both galaxies harbor super-massive black holes in their centers and are actively forming new stars in their disks. Arp 240 is located in the constellation of Virgo, approximately 300 million light-years away. With the exception of a few foreground stars from our own Milky Way all the objects in this image are galaxies.



UGC 8335 is a strongly interacting pair of spiral galaxies. The interaction has united the galaxies via a bridge of material and has extracted two strongly curved tails of gas and stars from the outer parts of their bodies. Both galaxies show dust lanes in their centers. UGC 8335 is located in the constellation of Ursa Major, the Great Bear, about 400 million light-years from Earth.



II Zw 96 is a system of merging galaxies with a bizarre shape. Powerful young starburst regions hang as long threadlike structures between the main galaxy cores. The system almost qualifies as an ultra-luminous system, but has not yet reached the late stage of coalescence that is the norm for most ultra-luminous systems. II Zw 96 is located in the constellation of Delphinus, the Dolphin, about 500 million light-years away from Earth.



IC 883 displays a complex and very disturbed central region with two tidal tails of approximately the same length emerging at nearly right angles: one diagonally to the top-right of the frame and the other to the bottom-right. The twin tidal tails suggest that IC 883 is the remnant of the merger of two gas-rich disk galaxies. The collision appears to have triggered a burst of star formation, indicated by a number of bright star clusters in the central region. IC 883 is 300 million light-years away toward the constellation of Canes Venatici, the Hunting Dogs.



Arp 256 is a stunning system of two spiral galaxies in an early stage of merging. The *Hubble* image displays two galaxies with strongly disrupted shapes and an astonishing number of blue knots of star formation. The galaxy to the left has two extended ribbon-like tails of gas, dust, and stars. The system is a luminous infrared system radiating more than a 100 billion times the luminosity of our Sun. Arp 256 is located in the constellation of Cetus, the Whale, about 350 million light-years away.



NGC 6090 is a pair of spiral galaxies with an overlapping central region and two tidal tails formed from material ripped from the galaxies by gravitational interaction. The two visible cores are approximately 10,000 light-years apart, suggesting that the two galaxies are at an intermediate stage in the merging process. The *Hubble* image reveals bright knots of newborn stars in the region where the two galaxies overlap. NGC 6090 is located in the constellation of Draco, the Dragon, about 400 million light-years away from Earth. Fainter and more distant background galaxies are also seen.



VV 705, or Markarian 848, consists of two galaxies that seem to be embracing each other. Two long, highly curved arms of gas and stars emerge from a central region with two cores. One arm, curving clockwise, stretches to the top of the image where it makes a U-turn and interlocks with the other arm that curves up counterclockwise from below. The two cores are 16,000 light-years apart. The pair is thought to be midway through a merger. Markarian 848 is located in the constellation of Bootes, the Herdsman, and is approximately 550 million light-years away from Earth.



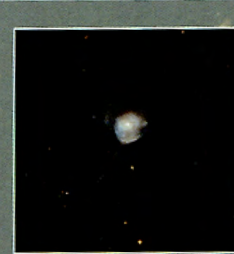
VV 247, or Arp 8, is a strongly interacting pair of galaxies, seen about 100 million years after their closest approach. It consists of NGC 6621 (to the left) and NGC 6622 (to the right). NGC 6621 is the larger of the two, and is a very disturbed spiral galaxy. The encounter has pulled a long tail out of NGC 6621 that has now wrapped itself around its body. The collision has also triggered extensive star formation between the two galaxies. The pair is located in the constellation of Draco, the Dragon, approximately 300 million light-years away from Earth.



NGC 6670 is a pair of overlapping edge-on galaxies, seen edge-on. Scientists believe that NGC 6670 has already experienced at least one close encounter and is now in the early stages of a second. The nuclei of the two galaxies are approximately 50,000 light-years apart. NGC 6670 glows in the infrared with more than a hundred billion times the luminosity of our Sun and is thought to be entering a starburst phase. The pair is located some 400 million light-years away from Earth in the constellation of Pavo, the Peacock.



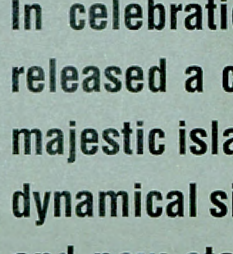
This *Hubble* image displays a pair of interacting spiral galaxies with swirling arms. The smaller of the two, dubbed LEDA 62867 and positioned to the left of the frame, seems to be safe for now, but will probably be consumed by the larger spiral galaxy, NGC 6786 (to the right). There is already some disturbance visible in both components. The pair is number 538 in Karachentsev's Catalog of Pairs of Galaxies. A supernova was seen to explode in the large spiral in 2004. NGC 6786 is located in the constellation of Draco, the Dragon, about 350 million light-years away.



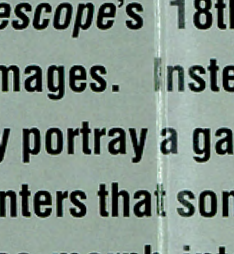
Galaxy NGC 17 displays tidal tails indicative of the merger of two formerly distinct galaxies. These galaxies now appear to have nearly completed their merger. The galaxy features a single nucleus, containing a blue central disk with delicately fine structure visible in its outer parts. The remnant shows clear signs that the merger was gas-rich and accompanied by a strong starburst. NGC 17 remains gas-rich, and can sustain its central star-forming activity for some time to come. The galaxy is located about 250 million light-years away in the constellation of Cetus, the Whale.



AM 1316-241 is made up of two interacting galaxies—a spiral galaxy (to the left of the frame) in front of an elliptical galaxy (to the right). The starlight from the elliptical galaxy is partially obscured by bands and filaments of dust associated with the foreground spiral. The *Hubble* image captures fine details in these patchy clumps of dust, which are contained within the arms of the spiral galaxy. This dust reddens background light just as the intervening dust in the Earth's atmosphere reddens sunsets here. AM1316-241 is located some 400 million light-years away toward the constellation of Hydra, the Water Snake.



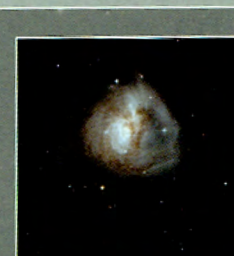
ESO 148-2 consists of a pair of former disk galaxies undergoing a collision. The cores of the two individual galaxies (seen at the center of the image) are embedded in hot dust and contain a large number of stars. Compared to an owl in flight, its two huge wings sweep out from the center and curve in opposite directions. These are tidal tails of stars and gas that have been pulled from the easily distorted disks of the galaxies. This cosmic owl is one of the most luminous infrared galaxies known and is located some 600 million light-years away from Earth in the constellation of Tucana, the Toucan.



ESO 255-7 consists of a quartet of interacting galaxies. Four galaxies are embedded in a common structure with an arc-like shape. The upper part of this structure appears almost like one single galaxy, but has, in fact, two component galaxies. The lowest galaxy is substantially obscured by dust. The interacting group is about 550 million light-years away from Earth, in the constellation of Puppis, the Stern.



NGC 5331 is a pair of interacting galaxies beginning to interlock their arms. There is a blue trail that appears in the image flowing to the right of the system. NGC 5331 is very bright in the infrared, with about 100 billion times the luminosity of the Sun. It is located in the constellation of Virgo, the Maiden, about 450 million light-years away from Earth.



NGC 3256 is a peculiar galaxy that is actually the relic of a collision between two separate galaxies that took place in the distant past. The telltale signs of the collision are two extended luminous tails swirling out from the galaxy. NGC 3256 belongs to the Hydra-Centaurus supercluster complex and provides a nearby template for studying the properties of young star clusters in tidal tails. The system hides a double nucleus and a tangle of dust lanes in the central region. The tails are studded with a particularly high density of star clusters. NGC 3256 is located in the constellation Vela about 100 million light-years away.



UGC 12812, also known as Markarian 331, is a spiral galaxy with no obvious tidal tails. It is located in the lower part of the *Hubble* image. Two neighboring blue galaxies are seen at the top of the frame. The galaxy at the very top is embellished by a remarkable number of blue star knots. Observations point to the presence of a giant black hole at the center of the bright core of UGC 12812. It is an open question as to whether Markarian 331 is actually a merging system, or whether its infrared brightness stems from another process. It is located in the constellation of Pegasus, the Winged Horse, about 250 million light-years away from Earth.



NGC 6240 is a peculiarly shaped galaxy consisting of two smaller merging galaxies. Observations with NASA's *Chandra X-ray Observatory* have disclosed two giant black holes, about 3,000 light-years apart, which will drift toward one another and eventually merge together into a larger black hole. The merging process, which began about 30 million years ago, triggered dramatic star formation and sparked numerous supernova explosions. The merger will be complete in some tens-to-hundreds of millions of years. NGC 6240 lies in the constellation of Ophiuchus, the Serpent Holder, some 400 million light-years away.



This pair of interacting galaxies consists of NGC 5754, the large spiral at the top center, and NGC 5752, the smaller companion in the bottom left corner. NGC 5754's internal structure has hardly been disturbed by their interaction, but its outer elements do exhibit some tidal features. In contrast, NGC 5752 has undergone a starburst episode, with many luminous star clusters clumping around the core, and along its intricate dust lanes. The contrasting reactions of the two galaxies to their interaction are due to their differing masses and sizes. The pair is located in the constellation Bootes, the Herdsman, 200 million light-years away.



This pair of interacting galaxies consists of NGC 5754, the large spiral at the top center, and NGC 5752, the smaller companion in the bottom left corner. NGC 5754's internal structure has hardly been disturbed by their interaction, but its outer elements do exhibit some tidal features. In contrast, NGC 5752 has undergone a starburst episode, with many luminous star clusters clumping around the core, and along its intricate dust lanes. The contrasting reactions of the two galaxies to their interaction are due to their differing masses and sizes. The pair is located in the constellation Bootes, the Herdsman, 200 million light-years away.