

ASSA DEEP SKY BULLETIN
COSMIC COLLISIONS: OBSERVING THE ANTENNAE GALAXIES (NGC 4038
AND NGC 4039) AND THE LOPSIDED GALAXY (NGC 4027)
IN THE CONSTELLATION OF CORVUS

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A INTRODUCTION

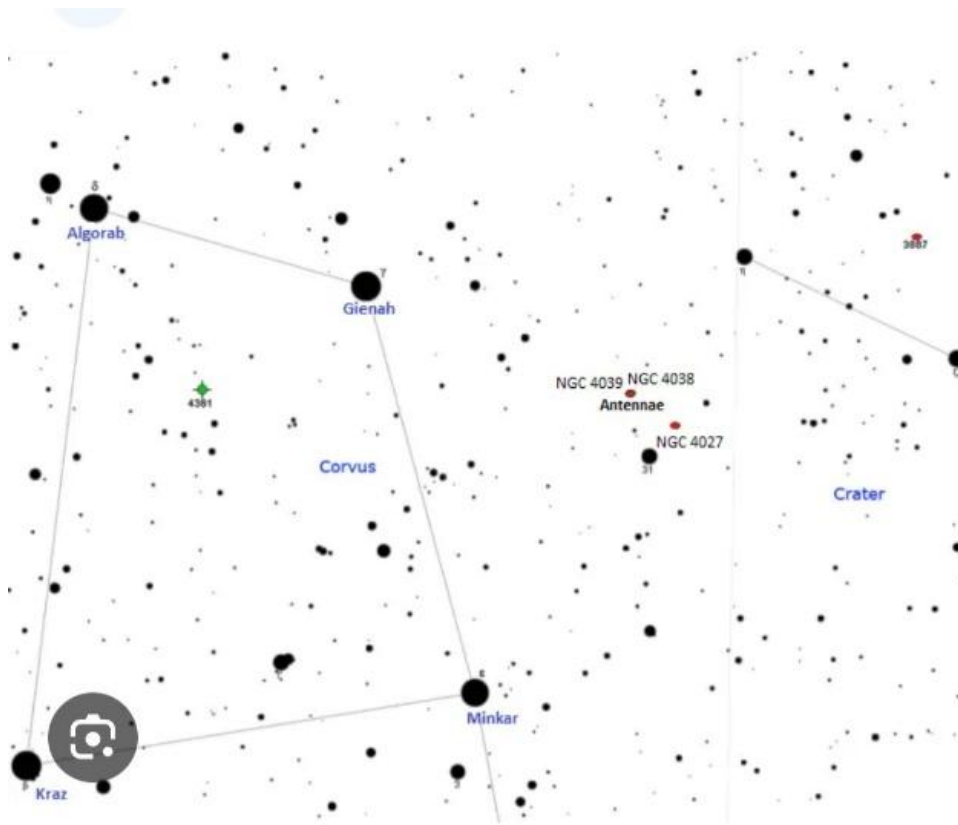
Violent and commonplace in the depths of the universe, mergers and collisions wreak havoc on galaxies and trigger the births of starclusters and black holes.

The constellation of Corvus, the Crow, is a small but distinctive constellation which lies in the Southern Sky near Virgo and Hydra. While not as rich in deep sky objects as some of its larger neighbours Corvus boasts a selection of fascinating galaxies that are well worth the attention of amateur astronomers. Among these, the Antennae and Lopsided galaxies stand out as the most impressive interacting and collision mangled galaxies in the night sky. Standing under the stars and looking up at the light of the Milky Way, our home galaxy, you would never guess such extremely violent events are taking place. But they are. Galaxies merge with astonishing regularity, colliding and combining in cataclysmic events that form supergalaxies. In more massive cases, two or more large galaxies coalesce to form a galactic monster – a giant elliptical galaxy that can dominate a cluster of galaxies (e.g. M87 in the Virgo cluster). One can say that galaxies don't like to leave each other alone. In part, that's because the universe is crowded on galactic scales. Galaxies are massive objects, too – from a few million to a few trillion times the mass of the sun – so their gravity is very strong. As a result, every galaxy extends gravitational 'tentacles' that grab at its galactic neighbours. The tentacles are strong enough to bind large groups of galaxies into clusters. Now for a closer look into the galactic gems of the Corvus constellation.

B THE ANTENNAE GALAXIES (NGC 4038 AND 4039) AND THE LOPSIDED GALAXY (NGC 4027)

1 THE ANTENNAE GALAXIES (NGC 4038 AND 4039)





1.1 **OVERVIEW**

Discovered by William Herschel in 1785. One of the most famous interacting galaxy pairs, the Antennae galaxies, provide a striking example of galactic collision and evolution.

These galaxies are among the closest and most well-studied examples of galactic mergers.

These two barred spiral galaxies are in the midst of a dramatic merger, with long tidal tails of stars and gas stretching outward. Visible in moderate to large telescopes, the Antennae galaxies appear as a pair of bright, overlapping cores with diffuse structures extending outward. In long term exposure astrophotography, their distinctive tidal streams create a truly breathtaking sight. The entire system spans more than 500 000 light years. As is the case with all such mergers, this one probably began as a gentle flirtation. As the two galaxies passed near each other several hundred million years ago, each one tugged at each other's disk. This tidal interaction, which works like the Moon's tidal effects on Earth, pulled long ribbons of stars, gas, and dust into space. Over time, gravity slowed the galaxies with respect to each other, so they moved closer together and became more tightly locked in each other's embrace. When the disks overlapped, they begin to act as if glued together.

The orbital energy of the galaxies is then transferred to the orbital energy of individual stars and the galaxies start falling into each other. After two or three interactions, the nuclei fall together and whipping up all the surrounding stars.

Once that happens, it only takes about one more orbit to complete the merger. As the two spiral galaxies entwine, vast clouds of gas slam into each other. The collision robs them of angular momentum, so they fall toward the center of the merging galaxies, triggering new star formation.

Mergers may also produce new globular star clusters – dense clusters that pack a few hundred thousand to a few million stars into a spherical region of space a few dozen light years across. Astronomers have discovered more than 700 possible globular clusters in the Antennae galaxies, for example – some of them no more than 10 million years old. More than a 150 globular clusters orbit the core of the Milky Way, but they contain the oldest stars in the galaxy. The Antennae's clusters are much brighter and bluer than the Milky Way's because they contain many hot young blue stars. These energetic stars will die off quickly, though, leaving populations of older, redder stars behind like those in the Milky Way's globular clusters. Modern telescopes, including the Hubble Space telescope (HST), the James Web Space Telescope (JWST) and Atacama Large Millimeter Array (ALMA), have revealed incredible details of star formation triggered by the collision. The two extended tidal tails, resembling insect antennae, formed due to strong gravitational interactions.

1.2 OBSERVATIONAL DATA

- 1.2.1 Designation: Antennae Galaxies NGC 4038 and 4039 (also known as the Ring Tail Galaxy), ARP 244, PGC 37967/37969, Caldwell 60 and 61.
- 1.1.1 Constellation: Corvus
- 1.1.2 Right ascension: 12h 01m 53.0s/12h
- 1.1.3 Declination: -18° 52' 10"/-18° 53' 11"
- 1.1.4 Magnitude: -10.5 (combined)
- 1.1.5 Size: 5.2' x 3.1'
- 1.1.6 Distance: 60 million light years.

1.3 ASTROPHYSICAL SIGNIFICANCE

NGC 4038/4039 provide valuable insight into galactic mergers and starburst activity. The collision has triggered intense star formation, particularly in the overlapping region of the two galaxies. These events serve as a model for what may happen when the Milky Way collides with the Andromeda galaxy in the distant future.

1.4 OBSERVATIONAL TIPS

- 1.4.1 Best time to observe: late March to May.
- 1.4.2 Telescope requirements: visible in medium to large telescopes under dark skies, the Antennae galaxies appear as a faint, irregular mass with hints of elongation. A 10-inch (250mm) telescope can reveal the core regions of each galaxy, while larger apertures (16 inches and above) may show some of the fainter tidal tails. Astrophotographers can

capture remarkable detail with long-exposure imaging, revealing the complex structures of the interacting galaxies.

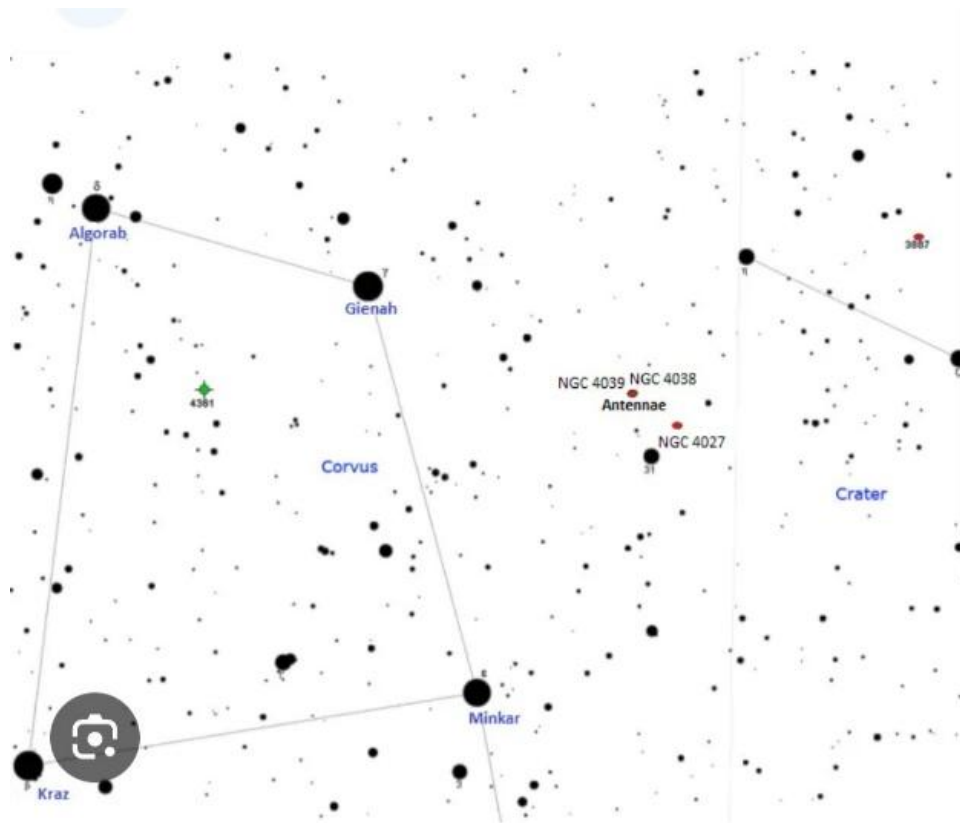
1.4.3 Appearance: from medium to large telescopes the Antennae galaxies appear as a faint irregular mass with hints of elongation.

1.4.4 Filters: Broadband filters can help slightly with contrast but the best views, however, come under dark, transparent skies.

1.5 CONCLUSION

The Antennae galaxies are a fascinating deep sky target for amateur and professional astronomers alike. Their dynamic structures, ongoing interaction and spectacular star-forming regions make them an essential study for those interested in galactic evolution.

2 THE LOPSIDED GALAXY (NGC 4027)



2.1 OVERVIEW

NGC 4027, sometimes referred to as ARP 22, is a peculiar barred spiral galaxy located in the constellation of Corvus. It earns the nickname “The

Lopsided Galaxy” due to its highly asymmetrical spiral arm structure – a striking deviation from the symmetry expected in classical spiral galaxies. This unusual appearance is the result of gravitational interactions, most likely a past collision with a smaller companion galaxy. Its an excellent example of galactic dynamics at play and is an intriguing target for amateur astronomers equipped with moderate to large telescopes (200mm and above).

2.2 OBSERVATIONAL DATA

2.2.1 Designation: NGC 4027, ARP 22

2.2.2 Constellation: Corvus

2.2.3 Right ascension: 11h 59m 30.5s

2.2.4 Declination: -19°15' 56"

2.2.5 Apparent magnitude: 11.7

2.2.6 Size: 2.7' x 2.1'

2.2.7 Distance: 83 million light years

Its unique structure – with one spiral arm extended significantly further than the other – makes it a cataloged member of Halton Arp's 'Atlas of Peculiar Galaxies' as object number 22.

2.3 ASTROPHYSICAL SIGNIFICANCE

NGC 4027 is an important object in the study of galactic morphology and interactions. Its lopsided structure provides evidence of how gravitational interactions can distort galaxies and trigger asymmetries in star formation and gas distribution. By studying such galaxies, astronomers gain insights into:

2.3.1 Galaxy evolution through mergers and tidal encounters.

2.3.2 Starburst activity and induced star formation from gravitational compression.

2.3.3 The behavior of bar dynamics and how bars influence spiral arm structure.

NGC 4027 is also thought to have interacted with a dwarf galaxy in the past, an event that may have pulled one spiral arm outward dramatically while leaving the rest relatively intact. A glancing blow if you like.

2.4 OBSERVATION TIPS

2.4.1 Best time to observe: late March through May, when Corvus is high in the sky.

2.4.2 Telescope requirements: at least a 6-8 inch (150-200mm) telescope for basic observation. A 10-inch or larger aperture under dark skies is ideal for resolving more detail.

2.4.3 Appearance: In small telescopes, NGC 4027 appears as a faint, oval smudge. With larger apertures and good-seeing, the central bar becomes noticeable and the asymmetrical extension of the spiral arm can faintly be discerned.

2.4.4 Filters: Broadband filters can help slightly with contrast but the best views come under dark, transparent skies.

2.5 CONCLUSION

NGC 4027 is more than just an odd-shaped galaxy – its a cosmic record of galactic collision and transformation, visible across millions of light years. While not as famous as its neighbours in the Corvus constellation, it holds a wealth of astrophysical intrigue for observers with the right equipment, NGC 4027 offers a glimpse into the dynamic and often chaotic lives of galaxies – a perfect deep sky target for those seeking something both visually and intellectually rewarding.

C CLOSING REMARKS

Although small in size, Corvus holds a treasure trove of interacting and peculiar galaxies. From the dramatic collision of the Antennae galaxies to the warped structure of the Lopsided galaxy, these galaxies offer compelling views for observers with moderate to large (8 inch/200mm and above) telescopes.

Whether you are a visual astronomer or an astrophotographer, the galaxies of Corvus provide excellent targets to explore the dynamics of galactic evolution.

If human beings survive long enough, we might even experience such an event first hand. The Andromeda galaxy and the Milky Way are on a collision course. About 5 billion years from now, their disks may merge, perhaps forming a new giant elliptical galaxy and erasing all traces of our comfortable galactic home.

ACKNOWLEDGEMENTS

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I wish you all clear skies and happy observations!

Colin Steyn