

New Hubble image of the Twin Jet Nebula

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The Twin Jet Nebula, or PN M2-9, is a striking example of a bipolar planetary nebula. Bipolar planetary nebulae are formed when the central object is not a single star, but a binary system. Studies have shown that the nebula's size increases with time, and measurements of this rate of increase suggest that the stellar outburst that formed the lobes occurred just 1200 years ago. Credit:

ESA/Hubble & NASA Acknowledgement: Judy Schmidt

The shimmering colours visible in this NASA/ESA Hubble Space Telescope image show off the remarkable complexity of the Twin Jet Nebula. The new image highlights the nebula's shells and its knots of expanding gas in striking detail. Two iridescent lobes of material stretch outwards from a central star system. Within these lobes two huge jets of gas are streaming from the star system at speeds in excess of one million kilometres per hour.

The cosmic butterfly pictured in this NASA/ESA Hubble Space Telescope image goes by many names. It is called the Twin Jet Nebula as well as answering to the slightly less poetic name of [PN M2-9](#).

The M in this name refers to Rudolph Minkowski, a German-American astronomer who discovered the nebula in 1947. The PN, meanwhile, refers to the fact that M2-9 is a planetary nebula. The glowing and expanding shells of gas clearly visible in this image represent the final stages of life for an old star of low to intermediate mass. The star has not only ejected its outer layers, but the exposed remnant core is now illuminating these layers - resulting in a spectacular light show like the one seen here. However, the Twin Jet Nebula is not just any [planetary nebula](#), it is a bipolar nebula.

Ordinary planetary nebulae have one star at their centre, bipolar nebulae have two, in a binary [star system](#). Astronomers have found that the two stars in this pair each have around the same mass as the Sun, ranging from 0.6 to 1.0 solar masses for the smaller star, and from 1.0 to 1.4 solar masses for its larger companion. The larger star is approaching the end of its days and has already ejected its outer layers of gas into space, whereas its partner is further evolved, and is a small white dwarf

The characteristic shape of the wings of the Twin Jet Nebula is most likely caused by the motion of the two central stars around each other. It is believed that a white dwarf orbits its partner star and thus the ejected gas from the dying star is pulled into two lobes rather than expanding as a [uniform sphere](#). However, astronomers are still debating whether all bipolar nebulae are created by binary stars. Meanwhile the nebula's wings are still growing and, by measuring their expansion, astronomers have calculated that the nebula was created only 1200 years ago.

Within the wings, starting from the star system and extending horizontally outwards like veins are two faint blue patches. Although these may seem subtle in comparison to the nebula's rainbow colours, these are actually violent twin jets streaming out into space, at speeds in excess of one million kilometres per hour. This is a phenomenon that is another consequence of the binary system at the heart of the nebula. These jets slowly change their orientation, [precessing](#) across the lobes as they are pulled by the wayward gravity of the binary system.

The two stars at the heart of the nebula circle one another roughly every 100 years. This rotation not only creates the wings of the butterfly and the two jets, it also allows the white dwarf to strip gas from its larger companion, which then forms a large disc of material around the [stars](#), extending out as far as 15 times the orbit of Pluto! Even though this disc is of incredible size, it is much too small to be seen on the image taken by Hubble.

An earlier image of the Twin Jet Nebula using data gathered by [Hubble's Wide Field Planetary Camera 2](#) was [released](#) in 1997. This newer version incorporates more recent observations from the telescope's [Space Telescope Imaging Spectrograph](#) (STIS).

A version of this image was entered into the Hubble's Hidden Treasures image processing competition, submitted by contestant Judy Schmidt.

Provided by ESA/Hubble Information Centre

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