

Total Solar Eclipse – 2024 – Latham Springs, TX - Telescope Observing Program NOTES



NGC3242 – The Ghost of Jupiter or Jupiter’s Ghost

This planetary nebula was discovered by William Herschel in 1785 and is also sometimes referred to as the *Eye Nebula*. The nebula measures around two light years long from end to end, and contains a central white dwarf with a bright apparent magnitude of 11.0. The inner layers of the nebula were formed some 1,500 years ago. The two ends of the nebula are marked by FLIERs, lobes of fast-moving gas often tinted red in false-color pictures. These represent the initial polar ejections of the aged star. An O III filter visually brings out the inner two ring structures.



NGC4088

NGC4088 is a grand design spiral galaxy which means the spiral arms in the disk are sharply defined. In visible light, one of the spiral arms appears to have a disconnected segment. Halton Arp included this galaxy in the *Atlas of Peculiar Galaxies*. The galaxy has massive distorted knotty arms with many HII regions. H α images show star forming emissions and radio images show strong star forming regions throughout the disk. NGC4088 is a member of the M109 Galaxy Group, which is a large group containing between 41 and 58 galaxies. Three supernovae have been observed in NGC4088.



NGC4214

NGC 4214 is a starburst galaxy, with the largest star-forming regions in the galaxy's center. A huge heart-shaped cavity (NGC4214-I) is seen at the center of the image and contains a large cluster of massive, Wolf-Rayet young stars ranging in temperature from 10,275° to 50,275° K. Their strong stellar winds create this hollow area resulting in a lack of gas which prevents any further star formation from occurring. However, NGC4214 contains a large amount of hydrogen gas and the area of highest concentration, NGC4214-II, lies in the upper part of this Hubble image and contains the youngest clusters of stars at only 2 million years of age. Two older superclusters have ages of 200 million years.



NGC4302 (Left) – NGC4298 (Right)

These galaxies look different because we see them angled at different positions on the sky. They are actually very similar in structure and content and are members of the Virgo Galaxy Cluster. NGC4302 has a prominent, extended dust lane and is classified as a Seyfert active galaxy (LINER). Its diameter is about 87,000 LYrs and the dense, dusty filamentary matter in the disk is largely tracing matter ejected from the disk by energetic feedback from massive stars. The tilted NGC4298 is about 45,000 LYrs in diameter. At 17 billion solar masses, it is less than 2 percent of the Milky Way galaxy’s 1 trillion solar masses.



NGC4216

NGC 4216 is one of the largest and brightest spiral galaxies of the Virgo Cluster and like most spiral galaxies of this cluster it has a deficiency of neutral hydrogen within the galaxy's optical disk. It has a low surface density for a galaxy of its type and NGC4216 is considered an anemic galaxy, with a low star formation activity for a galaxy of its type. It’s disk shows pillar-like structures possibly caused by interactions with the intracluster medium or with nearby galaxies. Its halo hosts around 700 globular clusters (nearly 5 times more than the Milky Way), plus two stellar streams that are interpreted as two satellite galaxies being disrupted and absorbed by NGC4216.



NGC4361

NGC4361 is a young very-high-excitation planetary nebula, which is unusual in that it has four lobes, or jets, of ejected material instead of the standard two. Astronomers suspect there might be two dying stars inside the nebula, each producing a bipolar jet. NGC4361 contains a fast, expanding halo that is being overrun by an even faster central bipolar outflow. It's central star is an extremely hot [WC] Wolf-Rayet type star with a temperature of 270,000 K This is hotter than every classical Wolf-Rayet star known and is the hottest known non-neutron star. It is nearly 18,000 times brighter than the Sun, but is only 6.1% its size. This star left the asymptotic giant branch between 5,776 and 8,018 years ago.



NGC4438 (Lower) – NGC4435 (Upper) -- (“Arp 120” – The “Eyes Galaxies”)

NGC4438 has a highly distorted disk, with long tidal tails due to its high speed gravitational interaction with other galaxies in the cluster and its companion, NGC4435. There is uncertainty surrounding the active (AGN) nuclear source, which may be a starburst region, or a black hole-powered nucleus. It also shows signs of a past, extended - but modest – starburst and a displacement of neutral hydrogen in the direction of NGC4435, which may have been caused by an off-center collision millions of years ago. NGC4435 is a barred lenticular galaxy with a relatively young (190 million years) stellar population within the galaxy's nucleus.



NGC4449 (Caldwell 21)

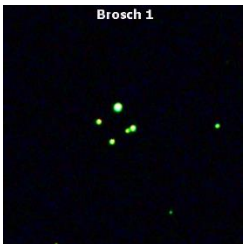
This is an irregular type galaxy and is similar to the Milky Way's satellite galaxy, the Large Magellanic Cloud (LMC), though is not as bright nor as large. NGC4449 has a general bar shape, also characteristic of the LMC, with scattered young blue star clusters. Unlike the Large Magellanic Cloud however, NGC4449 is a starburst galaxy due to its high rate of star formation, and it includes several massive and young star clusters, and at least one ultraluminous X-ray source (ULX). Photos show the pinkish glow of atomic hydrogen gas, the telltale tracer of massive star forming regions. Interactions with nearby

galaxies have influenced star formation and in 2012 two small galaxies were discovered interacting with NGC4449.



NGC4490 (The “Cocoon Galaxy -Lower) – NGC4485 (Upper) - (Arp 269 Both)

NGC4490 is a barred spiral galaxy and the pair is one of the closest interacting/merging galactic systems. It interacts with its smaller companion NGC4485 resulting in a starburst galaxy classification, with star formation found in both galaxies. The two galaxies have made their closest approach and are rushing away from each other. NGC4490 has a double nucleus and a stellar stream 25,000 light years long connects the two interacting galaxies. This stellar stream consists of bright knots and large gas rich pockets and young blue hot massive stars are formed in this region.



Brosch 1 (The “Virgo Diamond”)

Brosch 1 is classified as an asterism which is a small grouping of apparently related stars, but which actually are located at different distances and therefore are not gravitationally bound. Brosch 1 has a square or diamond shape, and consists of 5 stars with the brightest member, a red giant star, at the north at Mag. V = 11.5. Moving to the west is a nice double star, with a combined light of 11.6 Vmag. The southern star has a Vmag of 13.7 and the last star has a Vmag. 12.9. The color photograph indicates stars of a similar evolutionary stage, which could indicate these stars are all that is left of a much larger open cluster. If so then this is not an asterism, but a very poor open cluster remnant.



NGC4559 (Caldwell 36)

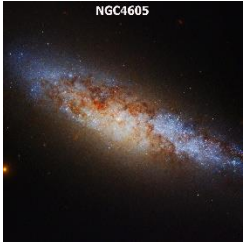
NGC4559 is an H II galaxy and an intermediate spiral galaxy with a weak inner ring structure. A luminous blue variable star, AT2016blu, discovered in 2012 shows repeated supernova-like outbursts, with 7 noted since it was discovered. Substantial reservoirs of material have been documented to exist outside the plane of disk galaxies. This extraplanar material has been found at multiple wavelengths and in multiple emission sources, including X-rays. NGC4559 has a thick-disk component at a scale height of ~6,520 light years, which is rotating at 16-31 miles.s⁻¹ slower than the uniform thin disk of neutral hydrogen gas. A dwarf galaxy is located about 189,000 LYrs away.



NGC4565 (Caldwell 38)

NGC4565 is a giant edge-on barred spiral galaxy which is more luminous than the Andromeda Galaxy. It has a slightly warped extended disk which is likely due to ongoing interactions with neighboring galaxies in the Coma group. It currently hosts two satellite galaxies, one of which is interacting, plus a population of roughly 240 globular clusters, nearly a hundred more than the Milky Way. The nuclear region is very obscured with dust, but it consists of two sources, a main nucleus and an off-center nuclear region which is 2 times brighter than the nucleus. They are separated by 0.8 arc-mins and are possible black hole binaries. This galaxy has the lowest broad H α luminosity found in any known active nucleus, indicating

a low star formation activity.



NGC4605

NGC4605 is a dusty dwarf barred spiral galaxy. Physically it is similar in size, in B-band absolute magnitude, and in rotation ($\sim 60 \text{ miles s}^{-1}$) to the Large Magellanic Cloud. This bright Sdm galaxy is situated in the general field between the M81 group and the CVn I cloud, and is a member of the M81 Galaxy Group, along with Messier 101. The kinematic or apparent center for this galaxy appears to be shifted by about 10 arc-seconds eastward from the morphological or rotational center, which leads to an asymmetric inner rotation curve.



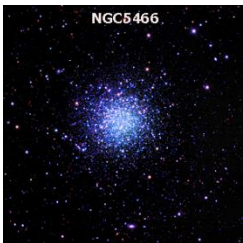
NGC4631 (The “Whale Galaxy”, Caldwell 32) – NGC4627

NGC4631 is a barred spiral galaxy and its slightly distorted wedge shape gives it the appearance of a whale, hence its nickname. It is seen edge-on from Earth and contains a central starburst, which is a region of intense star formation. This strong star formation is evident in the emission from ionized hydrogen and interstellar dust which is heated by the stars formed in the starburst. The most massive stars that form in star formation regions only last for a short period of time, after which they explode as supernovae. These supernovae create a superwind which blows gas out of the plane of NGC4631, creating a diffuse corona of hot, X-ray emitting gas, seen in X-ray emissions. The nearby NGC4627 is a dwarf elliptical galaxy.



NGC4636

NGC4636 is an elliptical galaxy with an apparent diameter of about 105,000 light years. The central region is circular and has an active galactic nucleus (AGN) that has been categorized as a LINER or type 1.9 Seyfert galaxy. The source of this activity is a small supermassive black hole with mass of 79 million Solar masses. This is surrounded by an elongated fainter envelope, which contains a large number of globular clusters. These 3,200 globular clusters have ages ranging from 2 to 14 billion years, which is much larger than that of galaxies of similar size. The younger clusters were formed during the merging of smaller galaxies. Molecular clouds are present and their dust further indicates a recent merger with a gas-rich galaxy.



NGC5466

NGC5466 is a class XII globular cluster which classifies it as a loose structured object, although its appearance seems otherwise. It is located 52,800 light years from the Galactic Center and was discovered by William Herschel on May 17, 1784. This globular cluster is unusual as it contains a blue horizontal branch of stars, indicating youth, as well as being unusually metal poor like ordinary globular clusters composed of older stars. NGC5466 is thought to be the source of a stellar stream discovered in 2006, which is approximately a 1.4° wide star lane which extends from Boötes to Ursa Major.



Napoleon's Hat

This is an asterism of stars which are all located at different distances, but from our perspective they appear to form a loose gravitationally bound star cluster. The asterism visually stands out very nicely from the background and is obvious, even in finder scopes. Its brightest star has a V_{mag} of 9.4 and it is large with an elongated diameter of 20.3 arc-minutes. The hat is located only 40 arc-minutes to the south of Arcturus, the fourth brightest star in the sky, and is often overlooked when observing the red-giant spectral type K0III star. It is large, so use a low power wide field eyepiece when viewing.



NGC5634

NGC5634 is a globular cluster in the constellation Virgo which is galaxy country, and this is the only globular cluster in the constellation. The bright orange star on the eastern edge is HD 127119 with a visual magnitude of 7.97 and spectral type K3III. It is at a distance of 1,900 light years, while the cluster is much further away at 82,200 light years. NGC5634's Shapley–Sawyer Concentration Class is IV, meaning the cluster shows an intermediate rich stellar concentration. NGC5634 was once likely a member of the Sagittarius Dwarf Spheroidal Galaxy (Sgr dSph) but the galaxy is being pulled apart by tidal forces from the Milky Way, which is how NGC5634 was pulled away from the Dwarf Spheroidal Galaxy.



NGC5676

This spiral galaxy is notably asymmetric, with the spiral arms on the south side of the galaxy chaotic in appearance, while those on the north side are very well-defined. Also, the spiral arms on the south side of the disk extend twice as far from the galaxy's nucleus as the spiral arms on the north side. The north part of the disk also contains a very intense region of star formation. The star formation within this region is more intense than the star formation in the galaxy's nucleus, and is the brightest infrared source within the disk. This is very unusual. Because of the fragmentary appearance of some of the spiral arms, this galaxy is classified as a flocculent galaxy.



NGC5907

NGC5907 has a very low low metallicity and few detectable giant stars. It is composed mostly of dwarf stars, but a significant young population of star clusters exists, located mostly along the outskirts of the stellar disk. It is host to 154 ± 40 globular clusters, about the same number as the Milky Way. NGC5907 has long been considered the prototypical example of a warped spiral in relative isolation. However, in 2006 an extended tidal stream surrounding the galaxy was discovered. This represents the ghostly trail of debris left along the orbit of a smaller satellite galaxy that was gradually torn apart and merged with

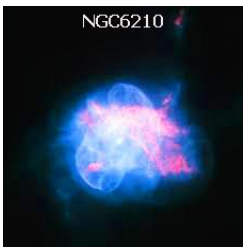
NGC5907 over four billion years ago.



NGC5897

NGC5897 is a metal-poor globular cluster located in the Galactic halo. It has a predominantly blue Horizontal Branch with a morphology that has been labeled "normal" considering its low metallicity. The cluster has a diameter of over 170 light years, and a Shapley–Sawyer Concentration Class of XI, meaning it has very low star density even in its center. It harbors several variable stars, mainly RR Lyrae stars. The stars of the cluster have only 0.91% of the Sun's metallicity, while the element abundances indicate the cluster formed in a time before the galaxy formed a disk and spiral arms. However, some

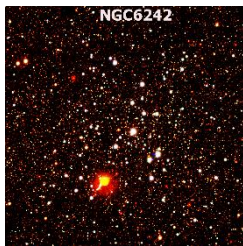
of the stars are apparently younger, indicating multiple star-forming epochs.



NGC6210

NGC6210 is bright, very amorphous and irregular in shape. It consists of two parts, a bright inner region filled with arches and filaments spanning $13'' \times 16''$, and a larger, fainter outer volume with a pair of "tubular" structures. The inner region is expanding at over 12-15 miles/second. The central star has a visual magnitude of 12.66 and an estimated temperature of 65,000 K. Its outflow has been measured at velocities of $1,355 \text{ miles s}^{-1}$, with an estimated mass loss rate of $2.2 \times 10^{-9} M_{\odot} \text{ yr}^{-1}$. The element abundances of the nebula suggest a low initial mass for the central star, of $\sim 0.9 M_{\odot}$. A collimated jet

feature to the northwest, suggests the central star is ejecting material along two and therefore possibly four directions.



NGC6242

An interstellar shocked gas cavity around the open cluster NGC6242 may have originated from a supernova explosion $\sim 220,000$ years ago of a massive star of 25 - 40 M_{\odot} . This apparently formed a black hole of 5-7 solar masses within GRO J1655–40, which may be a microquasar. If confirmed, this would be the first microquasar physically linked to a supernova, and one of the closest known black holes to the Sun. Microquasars are X-ray binary systems exhibiting relativistic radio jets. These systems contain compact objects like stellar black holes or neutron stars that accrete matter from a mass donor

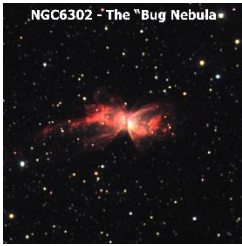
companion star.



NGC6284

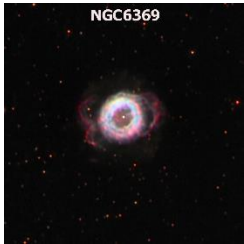
NGC6284 is a globular cluster with a Shapley–Sawyer Concentration Class of IX, meaning it is a moderately loose structure of stars of about 11.1 billion years of age. It is located in a rich star field close to the direction of the Galactic center. Fifteen variable stars are associated with the cluster, nine of which are RR Lyrae stars. A nearby metal-poor star HD 194598, may be a recent runaway star from NGC6284. NGC6284 does not appear to be a member of the Sagittarius Dwarf Spheroidal galaxy (Sgr dSph), as has been surmised, and is actually a member of the Milky Way Galactic bulge. There are hints of a tidal tail

emanating from the cluster which results from its crossing of the Galactic plane.



NGC6302, The “Bug Nebula”

NGC6302 is an extremely energetic and rapidly expanding bipolar planetary nebula with an age of about 2,200 years. The structure in the nebula is among the most complex ever observed in planetary nebulae which consists of at least four different pairs of uniformly expanding internal lobes, ejected at various times and orientations over the past two millennia at speeds ranging from 6–415 miles. s⁻¹. The nebula separates into an inner core of radius ~15” and two larger lobes, or butterfly wings to the E and W. The central star is a white dwarf with a current mass of 0.64 solar masses. It is one of the hottest stars known, with a surface temperature in excess of 250,000° C, implying that the star from which it formed must have been very large.



NGC6369, The “Little Ghost Nebula”

NGC6369 is a double-shell planetary nebula consisting of a bright annular inner shell with faint bipolar extensions and a filamentary envelope. The nebula's main ring structure is about a light-year across, and is a flattened equatorial structure known as a torus. This represents the initial equatorial ejection of material from the dying star which acts as a further constricting belt. We are viewing a bi-polar planetary nebula from a pole-on orientation from our point of view. The central star has a spectral type of [WO3], indicating a spectrum similar to that of an oxygen-rich massive Wolf–Rayet star, and Gaia data suggests that it may be a binary system. Nebula temperatures of NGC6369 have been reported to be ~70 000 K.



NGC6520

NGC6520 is a bright and visually obvious open cluster located in a very rich star field. It contains about 25 cluster members of magnitude 9 to 12 which span an apparent diameter of 5 arc minutes. The clusters age is about 60 million years. The dark nebula Barnard 86 lies near its western edge and appears to be located at a similar distance. However, the proper motions of the two objects are very different, by about 20 miles/second. This indicates they formed separately and are unrelated. They really are just “two ships passing in the night”, and therefore, NGC6520 was not formed in Barnard 86 as previously surmised.

Good Luck and Enjoy the Solar Eclipse:

Larry Mitchell