



Together let us explore the stars ...
John F. Kennedy

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PVAA Members Party



What's Up? - The Christmas Tree Cluster

In the Winter constellation of the Unicorn (Monoceros) east of Orion lies NGC 2264, the Christmas Tree Cluster. Discovered by William Herschel around Christmas Eve in 1783. Its starry evergreen tree shape was later given an official chart name by L.S. Copeland. In addition to the open cluster there are surrounding patches of glowing gas and dust that form an emission nebula some 20 light years long. At a distance of 2,500 light years it's not as visible to the naked eye as the nearby Orion Nebula (M42) at a mere 1,500 light years. But long exposure photos (picture) produce a colorfully complex "star nursery" with a holiday shape. It should be pointed out that the Christmas Tree Cluster Nebula is upside down to our eyes.

The most photographed part of NGC 2264 is the Cone Nebula which forms a dark conical angel decoration on the inverted top of the Christmas Tree. This hard edged absorption nebulae is formed by interstellar clouds so dense they block light from objects behind. It's full of sub-micrometre-sized dust particles wrapped in frozen gases. The molecular size of these potentially star forming particles inspires the name of Giant Molecular Clouds. Vast examples can even block out the Milky Way as does the Great Rift in Cygnus or the Coalsack in the Southern Cross (Crux). These looked like holes in the glowing mass of the Milky Way to early astronomers.

Most of the Christmas Tree Cluster's nebulosity is an

emission nebula illuminated by young blue stars and especially by its most visible star S Monocerotis. Sections of NGC 2264 have been given exotic names of their own. At the base of the Christmas Tree form are furry convolutions in the cloud which have been called the Fox Fur Nebula. In the center is a shape called the Snowflake Nebula. Rather like a Christmas Tree decoration.

Most of the illuminated gas cloud nebulas seen in our skies are emission nebulae. The light emission arises from gases ionized by high energy photons emitted from stars that have often been formed within the nebula. These star forming nebula are officially called H II (H two) regions. The color red orange is due to their large amounts of hydrogen.

Of course the term nebula means "fuzzy cloud" and came about when early astronomers noticed that beside stars and planets there were these gassy cosmic clouds. Eventually these became divided into various categories.

Dark nebulae are clouds of dust that block background light. The Horsehead Nebula in Orion is the most famous.

Emission nebulae are clouds of ionized high temperature gas. There are many huge examples, the gigantic Lagoon Nebula (M8) in Sagittarius. This constellation also includes the Swan or Omega Nebula (M17) and the Trifid Nebula (M20). Nearby is the Eagle Nebula (M16) in Serpens. All of these big nebulae also have star clusters like the Christmas Tree Nebula.

Reflection nebulae don't radiate on their own but reflect light from nearby stars. When this happens they appear blue. Most photographed is the very blue NGC 1977 (Running Man) near M42 in Orion.

Planetary nebulae grow from cast off shells of gas produced by dying stars (having nothing to do with planets but a rounded resemblance). This nebulosity is illuminated by the remains of the star at their centers. The Ring Nebula (M 57) in Lyra is bright and close. But some interstellar clouds are so vague in structure they're called diffuse nebulae.

The Unicorn constellation of Monoceros was inventively added to charts in 1624 by Dutch astronomer Petrus Plancius to fill in a dim area between Orion and Gemini. While it's form is as illusive as a flying reindeer it does contain deep sky objects in addition to the Christmas Tree. The enormous Rosette Nebula has five NGC objects including an open star cluster. It looks like a red Christmas poinsettia. Hubble's Variable Nebula (NGC 2261) changes as clouds periodically block its illuminating star. There was a supernova in 2002 that brightened

a million times from magnitude 15 to 6 leaving a impressive shell (V838 Monocerotis) at a distance of 60,000 ly! The odd Plaskett's Star is the most massive binary system known. Two stars 50 time as big as our Sun sweep around a common center every 15 days. A supernova in the making, it may some day cast off its own nebulosity (at a safe 5,000 ly away).

So there are a lot of surprise packages in this Winter sky of the Christmas Tree Cluster Nebula.



Lee Collins



Prize Table at the Party



Lee Collins

Leola Ott

Cori Charles

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Club Events Calendar

- January 9, 2016 Star Party--Salton Sea, Mecca Beach
- January 14, 2016 Board Meeting
- January 22, 2016 General Meeting

- February 6, 2016 Star Party--Anza Borrego State Park
- February 11, 2016 Board Meeting
- February 19, 2016 General Meeting

- March 5, 2016 Star Party--Cottonwood Springs, Joshua Tree
- March 17, 2016 Board Meeting
- March 25, 2016 General Meeting

- April 9, 2016 Star Party--Kelso Dunes
- April 14, 2016 Board Meeting
- April 22, 2016 General Meeting

Our Solar System Is Almost Normal, But Not Quite

One hundred years ago, Albert Einstein first put forth his theory of General Relativity, which laid out the relationship between spacetime and the matter and energy present within it. While it successfully recovered Newtonian gravity and predicted the additional precession of Mercury's orbit, the only exact solution that Einstein himself discovered was the trivial one: that for completely empty space. Less than two months after releasing his theory, however, the German scientist Karl Schwarzschild provided a true exact solution, that of a massive, infinitely dense object, a black hole.

One of the curious things that popped out of Schwarzschild's solution was the existence of an event horizon, or a region of space that was so severely curved that nothing, not light, could escape from it. The size of this event horizon would be directly proportional to the mass of the black hole. A black hole the mass of Earth would have an event horizon less than a centimeter in radius; a black hole the mass of the sun would have an event horizon just a few kilometers in radius; and a supermassive black hole would have an event horizon the size of a planetary orbit.

Our galaxy has since been discovered to house a black hole about four million solar masses in size, with an event horizon about 23.6 million kilometers across, or about 40 percent the size of Mercury's orbit around the sun. At a distance of 26,000 light years, it's the largest event horizon in angular size visible from Earth, but at just 19 micro-arc-seconds, it would take a telescope the size of Earth to resolve it – a practical impossibility.

But all hope isn't lost! If instead of a single telescope, we built an array of telescopes located all over Earth, we could simultaneously image the galactic center, and use the technique of VLBI (very long-baseline interferometry) to resolve the black hole's event horizon. The array would only have the light-gathering power of the individual telescopes, meaning the black hole (in the radio) will appear very faint, but they can obtain the resolution of a telescope that's the distance between the farthest telescopes in the array! The planned Event Horizon Telescope,

spanning four different continents (including Antarctica), should be able to resolve under 10 micro-arc-seconds, imaging a black hole directly for the first time and answering the question of whether or not they truly contain an event horizon. What began as a mere mathematical solution is now just a few years away from being observed and known for certain!

Ethan Siegel

Note: This month's article describes a project that is not related to NASA and does not suggest any relationship or endorsement. Its coverage is for general interest and educational purposes.

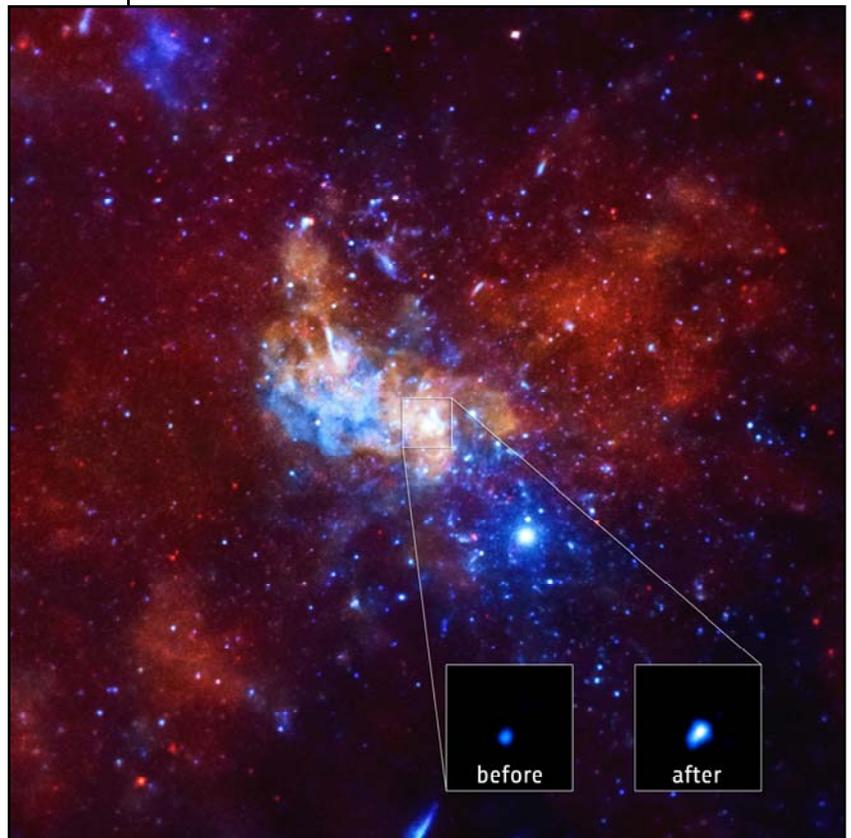


Image credit: NASA/CXC/Amherst College/D.Haggard et al., of the galactic center in X-rays. Sagittarius A is the supermassive black hole at our Milky Way's center, which normally emits X-ray light of a particular brightness. However, 2013 saw a flare increase its luminosity by a factor of many hundreds, as the black hole devoured matter. The event horizon has yet to be revealed.*



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