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The Observer

The Newsletter of Central Valley Astronomers of Fresno

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Astronomy Object of the Month- Chandra's X-Ray Universe

This is a familiar galaxy, M51, the Whirlpool, but seen in an entirely different light. The Chandra X-Ray Telescope, which has been orbiting the Earth since 1999, images in the high-energy x-ray part of the electromagnetic spectrum. In this case, what is being observed are x-ray binaries in M51, binary stars where one is drawing off material from the other, and in the process, heating it to temperatures hot enough to create x-rays. With its x-ray eyes, Chandra sees a universe much different than that of Hubble, one that for the past 17 years has given scientists a much broader perspective on the heavens. More on Chandra later in this issue.
Image-NASA/CXC/Wesleyan Univ.

Reminder to all CVA members-
The annual CVA Star-B-Que on Saturday, October 1
At Eastman Lake!

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A Clarity-Hubble and the Galactic Universe

By Larry Parmeter, *Observer* editor

In my talk on Edwin Hubble at the CVA meeting in May, one of the points made was that Hubble was not the first to discover that the galaxies are outside the Milky Way; several other astronomers, including Heber Curtis and Vesto Slipher, had already done that. Since then, I've come across a number of articles and references, as well as people, claiming that he was in fact the first, and all those other guys were just sore losers. To clear things up: scientists had known since the 1910s that the so-called "spiral nebulae" were outside the Milky Way; that was one of the main topics of the famous debate between Curtis and Harlow Shapley in 1920. The major piece of evidence for this was that the spiral nebulae were found to have redshifts, first discovered by Slipher as early as 1915, which strongly indicated that they were outside the Milky Way and far distant from it (there was general agreement among astronomers at the time that anything showing a redshift had to be incredibly far away; i.e., outside our galaxy). However, at the time there was no objective redshift formula to demonstrate exactly how far away they were. Hubble's finding of Cepheid Variables in M31 in 1924, and then using Henrietta Leavitt's period-luminosity correlation, which was proven to be highly reliable, gave the first relatively accurate distance to a "spiral nebula." So, yes, Hubble was probably the first to show that the "spiral nebulae" were far distant from the Milky Way, but he was not the first to prove that they were outside the Milky Way and "island universes" in their own right. That had been shown at least ten years earlier, as science historians now recognize, Hubble's announcement, though, of the distance to Andromeda received widespread publicity beyond the scientific community (it was first announced in *The New York Times*, not in a scientific setting), and, as a result the general public associated him with the discovery that the other galaxies were outside the our own and "universes" in their own right.

In a similar vein, although Hubble most likely did not know that Lemaitre had developed the velocity-recession correlation two years before he did, he probably did use Shapley's and Slipher's previous research on galaxies to come up with the idea that they were rushing away from the Milky Way. Slipher, through redshift studies, showed as early as 1916 that most other galaxies were moving away from ours. He just didn't label it or publicize it outside the scientific establishment. Like the old story in medicine where you think you're not ill until the doctor gives your condition a name, Hubble gave the galaxy recession phenomenon a name: the "Expanding Universe." And again, it resonated in the court of public opinion. As far as John Q. Doe was concerned, Hubble was identified not only with the idea that the galaxies were outside and far away from our own, but they were also all moving away from the Milky Way at tremendous speeds, the further the faster. The American public never heard of Lemaitre, Slipher, Curtis, or Shapley, but it knew all about Hubble, who was the right person in the right place at the right time. And that's the way science goes.



Cover page lower left-NGC 869 and NGC 884, commonly known as the Double Cluster in Perseus. Coming to a fall sky near you!

Profiles in Astronomy

William Hay 1888-1949

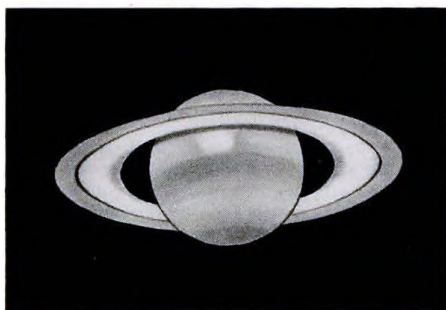
Hay was best known as a comic stage and film actor who became famous in England for his parody of a pompous and bumbling English schoolmaster. During his long acting career, he acted in many plays and made several popular movies based on his character. He was also, however, a dedicated amateur astronomer who made many contributions to science at the same time he acted on stage and film.

Hay was born in Stockton-on-Tees in County Durham, England. When he was a year old, his family moved to Suffolk, where he spent most of his young life. He worked briefly for an apprenticeship for an engineering firm after high school, then at 21 went into acting; he said years later that he was influenced by a W.C. Fields comedy film. By his early 30s he was a popular comic stage actor. In his early 40s, he began making film versions of his stage portrayals, which were also very popular. He also performed his routines on radio at times.

All the while Hay was acting, he was also making a name for himself as a noted astronomer. He built his own observatory at Mill Hill, at that time a semi-rural area to the north of London; it housed a 6" Cooke refractor which he used to make many discoveries. The most famous occurred on August 3, 1933, when he discovered a large white spot on the surface of Saturn, which he continued to observe and make detailed notes and drawings of for the next two months, until it faded. It was an atmospheric storm similar to the Great Red Spot on Jupiter, and Hay's discovery of it is considered to be the most important and famous of all the white spots found over the centuries on the ringed planet.

Hay also had an interest in comets; he calculated the positions and orbits of several of them and had them published. He also designed and built his own blink comparator to study their motion through the heavens. He as well studied stars, and contributed to several star catalogues. Besides the 6" refractor, he also had built a 12.5" reflector that he would take with him while touring with his acting company.

Hay was a member of both the British Astronomical Association and the Royal Astronomical Society, and was honored by both organizations when he died in 1949.



SATURN : AUGUST 3, 1933, 10:30 P.M.
SHOWING WHITE SPOT DISCOVERED BY THE AUTHOR

Above right-Hay with his 6" Cooke refractor at Mill Hill. Above-Hay's drawing of the Great White Spot on Saturn on August 3, 1933, the night he discovered it.

Sources-Wikipedia

Journal of the British Astronomical Association, "Hay and His Telescopes," vol 119, no 2, 2009

Images-BAA article

Running the Marathon

By Scott J. Davis

We have just finished the 2016 Summer Olympics in Rio, where some of the world's best runners ran 26.2 miles in their pursuit of gold. I am not one of those athletes; my marathon spans millions of light years and is done mostly while sitting. I am, of course, speaking of the Messier marathon.

When I joined the club back in November 2011 and began learning of the many wonders of the night sky, one of my earliest goals was to photograph all 110 objects in the Messier catalogue. It took me some time before I felt comfortable with my imaging and processing technique; for that reason, I consider my first completed image to be that of The Pleiades (M45), which I captured on January 3, 2013. My 110th object, Globular Cluster M69, was completed on July 8th of this year.

Because I felt the need to quantify some of the statistics that went into this imaging project, I put lots of data into a spreadsheet, and came up with four interesting numbers:

Total Number of Dark Sky Trips: 34
 Total Miles Traveled to Dark Skies: 4,634.7
 Total Number of Light Frames: 5,698
 Total Light Frame Exposure Time: 211 Hours, 19 Minutes, 50 Seconds

While I used the same mount (Celestron CGEM) to capture all of these objects, the passage of time did result in some equipment changes. Three different optics (Orion 8" Newt, Explore Scientific 4" Refractor, and Canon 200mm Lens) and three different cameras (Canon 60D, Canon T3i modified, and QSI 683 wsg-8) were used to capture the images. I have purposely decided not to add up the total money spent, as I really, really don't want to know.

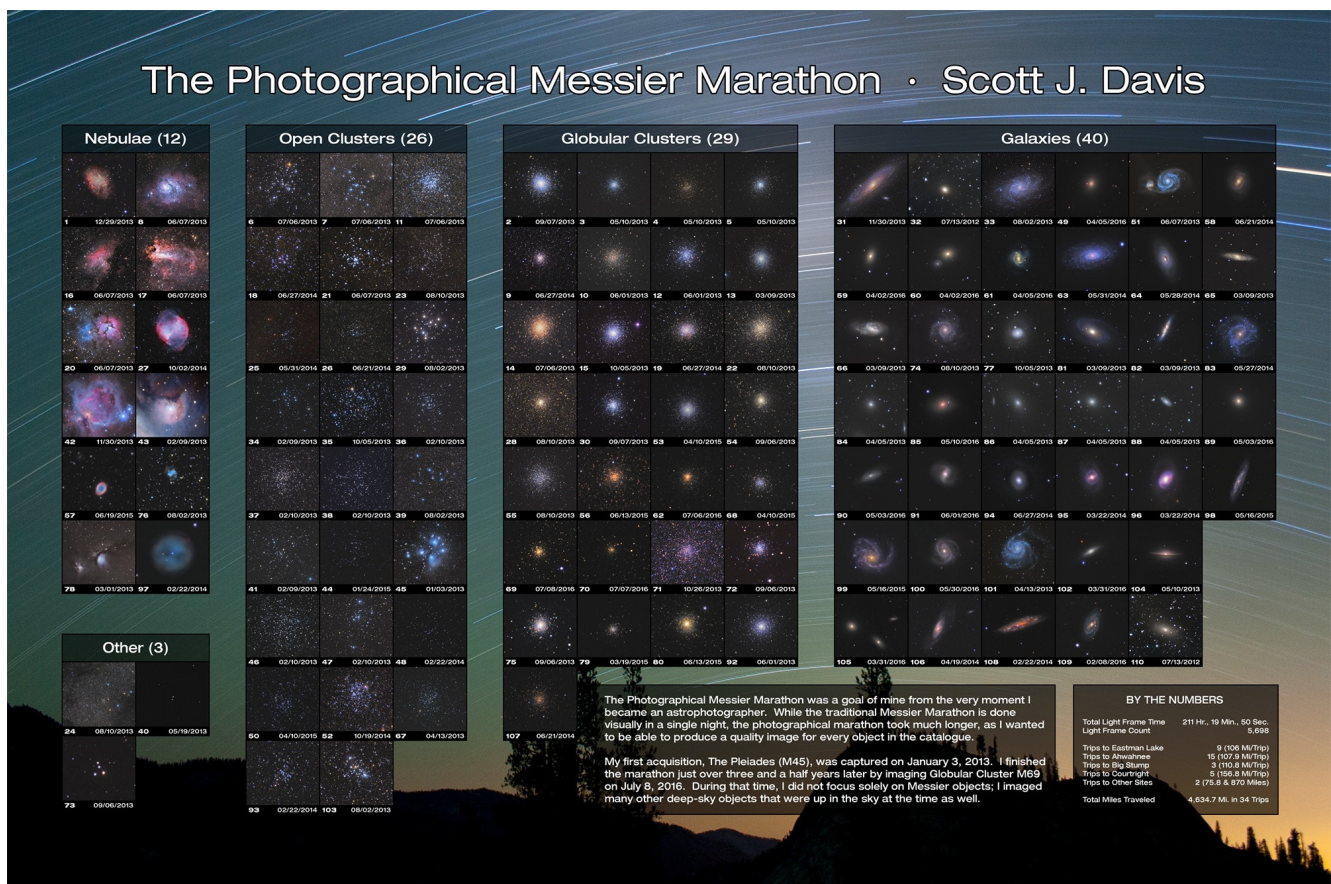
Astrophotography is a lot of work – careful attention to equipment setup, planning the image capture, getting good data, and processing the data are all factors. It also required very extensive planning – most of the objects, after all, are only visible during specific times of the year. Several objects were done this year because I failed to plan correctly and get them in prior years. It was a constant challenge to make sure that I was using my time as efficiently as possible.

I also knew ahead of time that I eventually would want to get my work printed. I went through several layouts and designs, eventually deciding on a 36" x 24" poster, which is included in this article. When printed at that size, the image of each object will be a 2-inch square. I also opted to separate the objects into their various categories, which resulted in a "periodic table" of sorts. I am quite happy with the way everything turned out.

It's also worth noting that most of the images represent my first-ever attempt at imaging each object. While I plan to go back to some of these objects and improve on them, I want this poster to represent my original attempts. I also figure that, with how much of a perfectionist I am, I would always want better versions of each image and, as a result, my poster would never get printed!

As a final thought, I want to take the time to acknowledge those whose kindness helped me achieve my photographic goal. The first thank-you goes to Casey Chumley and Clarence Noell, who invited me to my first star party at Hensley Lake and helped me feel a lot more comfortable in unfamiliar territory. To Steve Harness, who handed me a pair of binoculars at that star party and pointed me to some objects – I have never felt as excited about anything as I did after leaving that star party. To Dave Artis and Jarrod McNelly, who hosted me at their homes and gave me additional opportunities to photograph the cosmos. To Scott Rosen, who lives down in Pine Mountain Club and developed the processing techniques that I still use to this day. To all of the members of the Central Valley Astronomers, who allowed me to display my photos at meetings and have helped to encourage me in all of my astronomical pursuits. And finally, to my extremely tolerant, understanding, and loving wife, who has supported my efforts by allowing me to spend time away from the family and buy very expensive equipment to do something that I truly love to do.

Thank you to you all, and may you always have Clear Skies.



What's New in Space

Vandenberg Air Force Base

When Americans think of places where rockets are launched, they almost automatically gravitate towards the Kennedy Space Center in Florida, and its lesser known sibling, Cape Canaveral Air Force Station. As well, up the coast, in Virginia, is the Wallops Island launch facility. What many outside the aerospace and scientific community do not realize, though, is that a major space launch facility sits on the nation's west coast. This is Vandenberg Air Force Base, outside of Lompoc, about 100 miles north of Los Angeles and right on the Pacific Ocean.

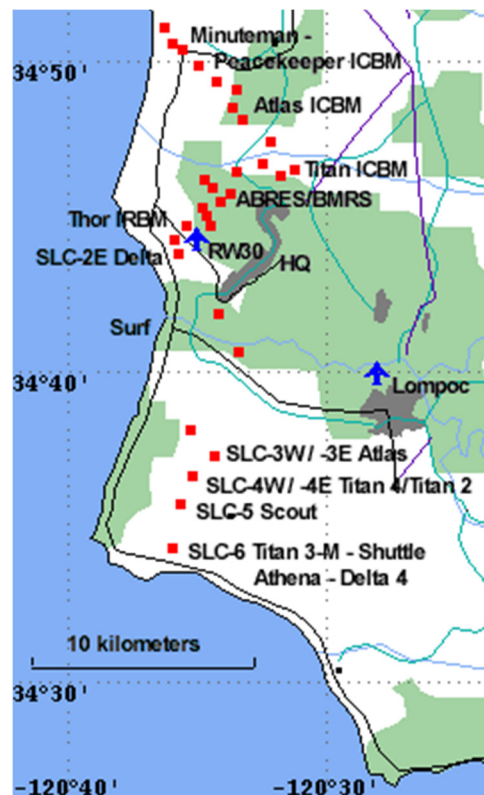
Vandenberg was established in 1941 as an Army training center, and was originally named Camp Cooke, after a Civil War general. Besides training duties, during World War II it also held German and Italian prisoners of war. After the war, it became a prison for military convicts. In 1956, the Air Force decided to use the base as a missile launch center for its Western Test Launch Center, to launch missiles into the Pacific, and, eventually, also for polar orbit launches. In 1957, the base was renamed Cooke Air Force Base, and several launch pads and support facilities were built. In 1958, the base was renamed Vandenberg Air Force Base, after former Secretary of the Air Force General Hoyt Vandenberg.

During the late 1950s and early 1960s, the base saw the testing and launching of several ICBMs, such as the Titan and the Atlas missiles. Also, underground silos were built to test launch the Navy's submarine carried missiles (the Navy had a small section of Vandenberg for its missile test programs). During the 1960s, Vandenberg was prepared to launch the Air Force's manned Dynasoar and MDL (Manned Orbiting Laboratory) programs, but both were eventually cancelled. With the coming of the Space Shuttle, Space Launch Complex 6 (SLC-6, known as Slick-6), which was originally built to launch the Titan III-MDL spacecraft, was modified to launch military space shuttle missions into polar orbits. The first shuttle launching from SLC-6 was scheduled for April 1986, but the Challenger disaster in January cancelled it, along with, eventually, all other Vandenberg Shuttle launches. During the 1980s and 90s, Vandenberg was increasingly used to launch classified military and intelligence agency satellites, as well as scientific spacecraft, into polar orbits. It, as well, continued its original program of test launches of ICBMs as part of the Pacific Test Range program. The underground silos scattered throughout the area also continued to be used for test launches of military missiles, most notably the MX "Peacekeeper" missile of the 1980s and 90s. In the early 2000s, two commercial space companies, Space-X and Orbital Sciences, built launch pads (actually converted old pads for their rockets) to launch commercial and scientific payloads into polar orbits.

Today, Vandenberg has six active launch pads for commercial, military, and scientific programs. SLC-2 is for the Delta II, SLC-3 launches the Atlas V, SLC-4 supports Space-X's Falcon 9 and Falcon-H (for Heavy) rockets, SLC-6 launches Delta IV rockets, SLC-8 is for Orbital Science's Minotaur rockets, and LC-576-E is for Orbital Science's Taurus rockets. There are also six active launch pads which are used for regular tests of the Minuteman III and MX missiles, as well as other smaller military rockets. The military ICBMs do not go into orbit, but are launched southwest over the Pacific Ocean and splash into the Western Pacific some six to seven thousand miles away.

One of the ironies about Vandenberg, a highly secure facility that is involved in a good deal of classified military work, is that, being on the California coast, parts of it are accessible to the public. Highway 1 goes through parts of the base, as does the California Amtrack coastal train route. Several popular public beaches on the coast are adjacent to the base, and beachgoers drive through the base to get to them. Nevertheless, the base continues its program of being the main rocket launch facility on the West Coast, and will no doubt do so for the foreseeable future.

Left-A Delta IV launching at Vandenberg



More What's New in Space

ISS Medical Studies Show a Serious and Disabling Problem

NASA medical researchers have recently reported a potentially serious impediment to long term space missions. Up to 80% of the astronauts and cosmonauts who have undertaken long term flights aboard ISS have had mild to significant deterioration of their eyesight. In the initial case, American astronaut John Phillips, who served aboard ISS for six months in 2005, had his visual acuity go from 20/20 to 20/100 after a few months in space. When he returned to Earth, and for some time afterwards, doctors could not trace the cause of the sudden change, but realized it was due to his stay aboard ISS, and through extensive medical tests, such as MRIs and retina scans, finally found what is the reason. They are not yet 100% certain, but believe that it is caused by the lack of gravity increasing the pressure on the fluid surrounding the brain, causing added pressure on the back of the eyeball. Long term space travelers with this condition have been found to have the back of their eyeballs flattened, the retinas pushed forward, and the optic nerves inflamed. Medical scientists have given a name to this condition, VIP, for Visual Impairment Intracranial Pressure syndrome. Since Phillips' case was diagnosed, many other astronauts and cosmonauts have been found to have the same symptoms which have affected their eyesight as well, although not as severely. Nevertheless, as NASA doctors point out, this could be a serious problem on even longer space flights, such as the projected trips to Mars, which will last up to two years each.

Another in a continuing series on lesser known, but still important, astronomical observatories throughout the world

The Rozhan Observatory

The Rozhan Observatory, also known as the Bulgarian National Astronomical Observatory, is located in a forested area in Smolyan Province, Bulgaria, with the nearest town being Chepelare, about ten miles distant. It is owned and operated by the Institute of Astronomy of the Bulgarian Academy of Sciences, and is at an altitude of 5,600 feet above sea level. It was officially established in 1981, the result of a twenty year effort by Bogomil Kovachev, one of Bulgaria's foremost scientists.



The observatory currently has four telescopes: a 2m Richey-Chretien reflector, a .6m Cassegrain reflector, a .7m Schmidt camera, and a .15m solar coronagraph. About 50 astronomers and graduate students use the observatory for everything from deep space studies to planetary observing to solar research. Its main discovery so far is of a minor planet which has been designated 6267 Rozhen. The Observatory has also discovered several asteroids and an exoplanet, designated WASP-3c.

The dome holding the 2m reflector at Rozhan Observatory

Number of extrasolar planets found as of August 2016-3,504
As of August 23-a planet has been found orbiting Proxima Centauri-
the closest star to our own-
How many more are out there-tens of thousands, hundreds of
thousands, millions?

From NASA's Space Place

By Ethan Segal

Is there a Super-Earth in the Solar System out beyond Neptune?

When the advent of large telescopes brought us the discoveries of Uranus and then Neptune, they also brought the great hope of a Solar System even richer in terms of large, massive worlds. While the asteroid belt and the Kuiper belt were each found to possess a large number of substantial icy-and-rocky worlds, none of them approached even Earth in size or mass, much less the true giant worlds. Meanwhile, all-sky infrared surveys, sensitive to red dwarfs, brown dwarfs and Jupiter-mass gas giants, were unable to detect anything new that was closer than Proxima Centauri. At the same time, Kepler taught us that super-Earths, planets between Earth and Neptune in size, were the galaxy's most common, despite our Solar System having none.

The discovery of Sedna in 2003 turned out to be even more groundbreaking than astronomers realized. Although many Trans-Neptunian Objects (TNOs) were discovered beginning in the 1990s, Sedna had properties all the others didn't. With an extremely eccentric orbit and an aphelion taking it farther from the Sun than any other world known at the time, it represented our first glimpse of the hypothetical Oort cloud: a spherical distribution of bodies ranging from hundreds to tens of thousands of A.U. from the Sun. Since the discovery of Sedna, five other long-period, very eccentric TNOs were found prior to 2016 as well. While you'd expect their orbital parameters to be randomly distributed if they occurred by chance, their orbital orientations with respect to the Sun are clustered extremely narrowly: with less than a 1-in-10,000 chance of such an effect appearing randomly.

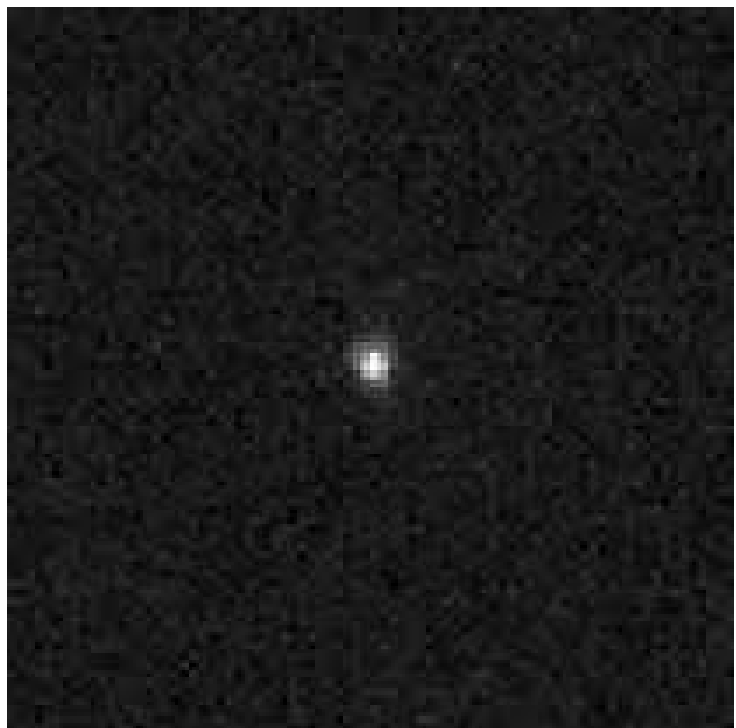
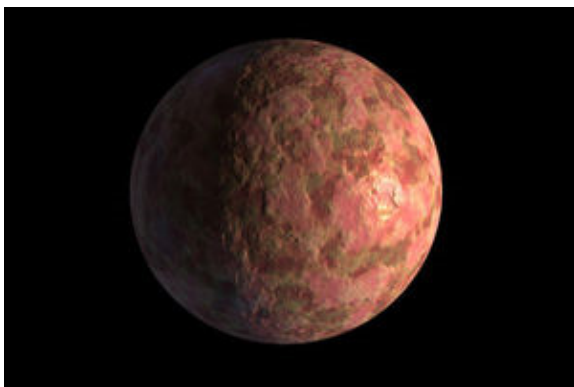
Whenever we see a new phenomenon with a surprisingly non-random appearance, our scientific intuition calls out for a physical explanation. Astronomers Konstantin Batygin and Mike Brown provided a compelling possibility earlier this year: perhaps a massive perturbing body very distant from the Sun provided the gravitational "kick" to hurl these objects towards the Sun. A single addition to the Solar System would explain the orbits of all of these long-period TNOs, a planet about 10 times the mass of Earth approximately 200 A.U. from the Sun, referred to as Planet Nine. More Sedna-like TNOs with similarly aligned orbits are predicted, and since January of 2016, another was found, with its orbit aligning perfectly with these predictions.

Ten meter class telescopes like Keck and Subaru, plus NASA's NEOWISE mission, are currently searching for this hypothetical, massive world. If it exists, it invites the question of its origin: did it form along with our Solar System, or was it captured from another star's vicinity much more recently? Regardless, if Batygin and Brown are right and this object is real, our Solar System may contain a super-Earth after all.

Hubble Space Telescope image of Sedna
Image-NASA/HST/STSI

Article courtesy of NASA's Space Place

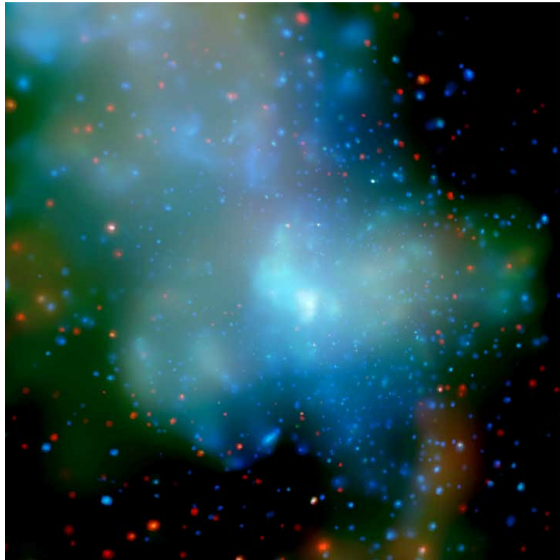
Below-artist's impression of Sedna
From space.com



Some Stunning Images by the Chandra X-Ray Telescope

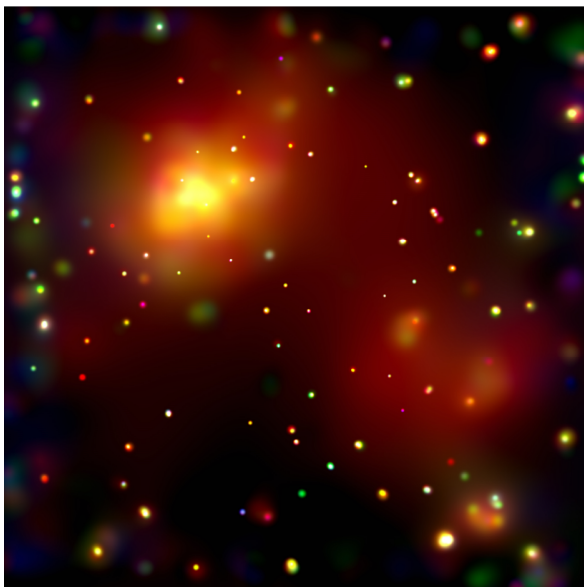
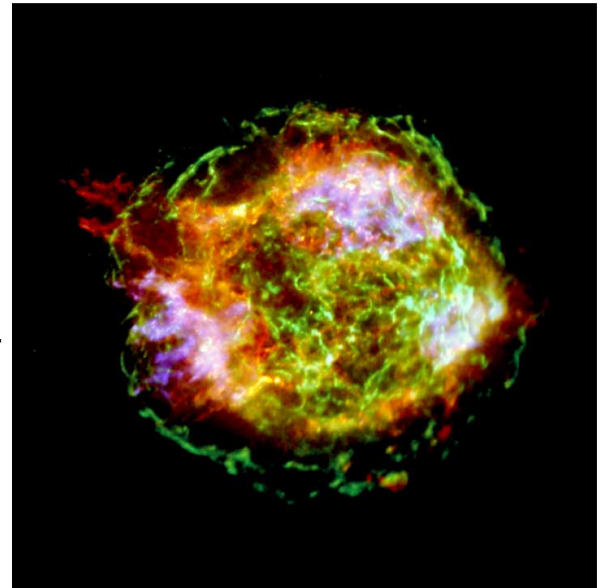
Overshadowed by the Hubble Space Telescope, the Chandra X-Ray Telescope, which was previously called the Advanced X-Ray Astrophysics Facility, has been quietly and methodically doing its work since its launch in 1999. Now in its 17th year of operation and still going strong, the telescope, named after the Nobel astrophysicist Subrahmanyan Chandrasekhar, has thrown open the high energy universe with its many discoveries in the x-ray part of the electromagnetic spectrum. Here are some of the best images by Chandra, less well known but no less enthralling than those of Hubble.

Right-Chandra. It is in a highly elliptical orbit of the Earth, which at times reaches almost a third of the way to the Moon. Instead of one mirror, it uses several conical "grazing" mirrors, arranged in concentric circles to capture highly energetic x-ray particles.



Left-Chandra's x-ray image of the center of the Milky Way, with the object known as Sagittarius A* (pronounced "A Star"), a probable black hole, near the center

Right-Cassiopeia A, a supernova remnant, as seen in x-ray vision. Based on Chandra's imaging, scientist now believe a black hole is at the center of Cassiopeia A.



Left-Chandra's hauntingly beautiful image of the galaxy cluster Abell 2125, showing high temperature gas clouds throughout the cluster. Abell 2125 is over one billion light years from Earth. In recent years, one of Chandra's main missions has been to image x-ray sources in far distant galaxies and clusters for evidence of dark energy and dark matter.