The Celestial Mechanic

The Official Newsletter of the Astronomy Associates of Lawrence

Volume 32 Number 07 **July 2006**

Calendar of Events
SUMMER STAR PARTY
WEDNESDAY
JULY 12, 2006

After the
BAND CONCERT
in South Park
SETUP ~ 9:15PM

KU STADIUM OBSERVING
Cancelled
until further notice

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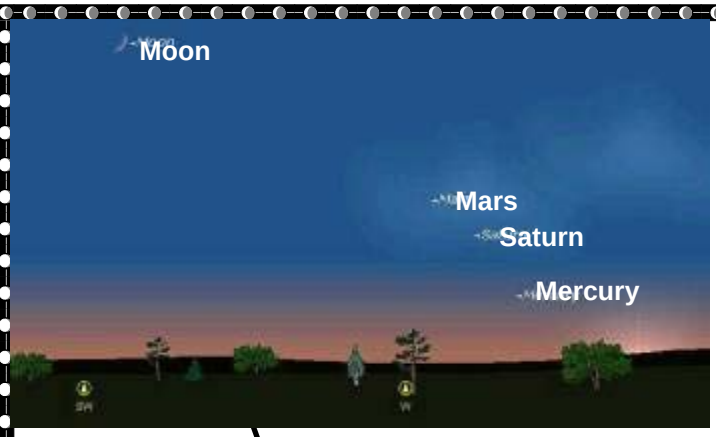
INSIDE THIS ISSUE

Report From the Officers on the JUNE Meeting:

While we didn't have a meeting, we did plan an event to kick off the summer— a star party after the band concert in South Park for the summer solstice. Though we haven't had much rain lately, the weather failed to cooperate—it was overcast with a high probability of thunderstorms, so the viewing was cancelled. We will, however, try again in July. The planned observing will take place after the band concert on Wed. July 12 in South Park on the west side of Massachusetts St. If you can come by and set up a telescope for viewing or would like to use one of the KU telescopes, please contact Bruce Twarog at btwarog@ku.edu. The tentative setup time is 9:15 PM, though it will be rather later when it becomes totally dark. Let's hope for clear skies!

Speaking of amateur observing, by the time you receive this, you may have seen the article by Mindie Paget in the Sunday, July 2 Journal-World. Ms. Paget talked with a variety of club members, Rick, William, and Bruce, and



SUNSET: 7/02/2006, ~9:00 PM

Catch Mercury in the west at twilight while you still can! It's fading daily. For the next few days, use binoculars shortly after sunset to look for little Mercury fading away to the lower right of Regulus, Mars, and Saturn. This is also a great month for viewing Jupiter and its strange new object, Red Spot Jr. The long-enduring, much-observed "white oval" on Jupiter designated BA has been reddening, and now its color is almost identical to the famous Great Red Spot. The oval lies in the South Temperate Belt. It follows the Great Red Spot by about 1 hour of Jupiter's rotation.

The new red spot, affectionately dubbed "Red Junior" or "Red Spot Junior" by some astronomers, is nearly half the size of the Great Red Spot, which means it has about the same diameter as Earth. It can be seen in telescopes with apertures 10 inches or larger. Check out Sky and Telescope (skypub.com) for when it will transit the planet.

From the Officers, continued

(Continued from page 1)

noted the observing planned for Wed. the 12th. This is being prepared prior to the appearance of the article, but we can hope that it presented amateur astronomy in a favorable light. At minimum, it might boost the attendance at the observing session in July, so come on out if you can.

Because of the slowdown in activities during the summer, we will return to our usual mode of not having monthly meetings until the summer is over. We are organizing a number of potential events/speakers for the Fall 2006 semester, so if you have any suggestions for topics, speakers, or public events, please contact Rick Heschmeyer with your ideas.

Reminders on upcoming events: The Nebraska Star Party, July 23-28, Valentine, NE –www.NebraskaStarParty.org— **NOTE:** there is a featured article on the NSP in the July 2006 issue of Sky and Telescope if you are still considering attending and want to know what it is like; **ALCON/EXPO** in Dallas, August 4-5, 2006 - http://www.alconexpo.com/.

The Astronomical League has many activities to encourage amateur astronomy including Observing Clubs. The Observing Clubs offer certificates of accomplishment for demonstrating observing skills with a variety of instruments and objects. Each Club offers a certificate based upon achieving certain observing goals. These are usually in the form of a specific number of objects of a specific group with a given type of instrument. Occasionally there are multiple levels of accomplishment within the club. There is no time limit for completing the required observing, but good record keeping is required. When you have reached the requisite number of objects, your observing logs are examined by the appropriate authority and you will receive a certificate and pin to proclaim to all that you have reached your goal. Many local astronomical societies even post lists of those who have obtained their certificates. This month we feature the details on the **Meteor Club**. Anyone who has spent time outdoors at night has seen an occasional "shooting star" in the dark sky. These fleeting streaks of light are nothing more than minute specks of interplanetary debris colliding with the upper regions of the Earth's atmosphere. What makes these tiny specks appear as bright streaks is the tremendous velocity at which they strike the Earth's atmosphere. Meteoroids (meteors traveling in space) can orbit the Sun at a velocity of up to 42 kilometers per second (26 miles per second). When these meteoroids encounter the Earth, they may enter the atmosphere a speeds up to 72 kilometers per second (45 miles per second). It is the tremendous friction that causes the meteor to produce light and to ultimately disintegrate before reaching the Earth's surface. Meteor observing is both fun and scientifically useful. It does not require expensive equipment, only your two eyes. Becoming a member of the Meteor Club only requires that you are willing to allocate some of your time to looking for nature's fireworks. In addition, your observations can contribute to research on meteors and meteor streams by the Association of Lunar and Planetary Observers (A.L.P.O.) (http://www.lpl.arizona.edu/alpo/). Details on the club and the requirements for the observational data may be found at http://www.astroleague.org/al/obsclubs/meteor/metrcl.html.

To share your data with the A.L.P.O., mail the report forms in a timely manner to the A.L.P.O. Meteors Section, 1828 Cobblecreek Street, Chula Vista, CA 91913, within 30 days of observation. Your report will then be added with other observers across North America and published in A.L.P.O.'s quarterly journal The Strolling Astronomer. The Section Recorder will archive a copy and send a copy to Europe for analysis by the International Meteor Organization. (http://www.imo.net/). Another organization interested in meteors and meteor observing is the American Meteor Society. You can get more information on them at http://www.amsmeteors.org/.

If you have any suggestions for talks, speakers, or public events, please feel free to contact us, particularly Rick Heschmeyer (rcjbm@sbcglobal.net), the events coordinator for the club. Hope to see you later this month after the Band Concert in July (Wed. the 12th).

ALL for now.

About the Astronomy Associates of Lawrence

The club is open to all people interested in sharing their love for astronomy. Monthly meetings are typically on the second Friday of each month and often feature guest speakers, presentations by club members, and a chance to exchange amateur astronomy tips. Approximately the last Sunday of each month we have an open house on Memorial Stadium. Periodic star parties are scheduled as well. For more information, please contact the club officers:Hannah Swift at hkswift@ku.edu, Gary Webber at gwebber@ku.edu, our faculty advisor, Prof. Bruce Twarog at btwarog@ku.edu. or our events coordinator, Rick Heschmeyer at rcjbm@sbcglobal.net. Because of the flexibility of the schedule due to holidays and alternate events, it is always best to check the Web site for the exact Fridays and Sundays when events are scheduled. The information about AAL can be found at

http://www.ku.edu/~aal.

Copies of the *Celestial Mechanic* can also be found on the web at

http://www.ku.edu/~aal/celestialmechanic

Hubble Eyes Star Birth in the Extreme

HST Press Release

Staring into the crowded, dusty core of two merging galaxies, NASA's Hubble Space Telescope has uncovered a region where star formation has gone wild.

The interacting galaxies appear as a single, odd-looking galaxy called Arp 220. The galaxy is a nearby example of the aftermath of two colliding galaxies. In fact, Arp 220 is the brightest of the three galactic mergers closest to Earth. This latest view of the galaxy is yielding new insights into the early universe, when galactic wrecks were more common.

The sharp eye of Hubble's Advanced Camera for Surveys has unveiled more than 200 mammoth star clusters. The newly found clusters far outnumber the six spied by Hubble in a 1992 observation of Arp 220 taken by the Wide Field Planetary Camera, which did not have the sharpness of the Advanced Camera. The heftiest Arp 220 cluster observed by Hubble contains enough material to equal about 10 million suns, which is twice as massive as any comparable star cluster in the Milky Way Galaxy.

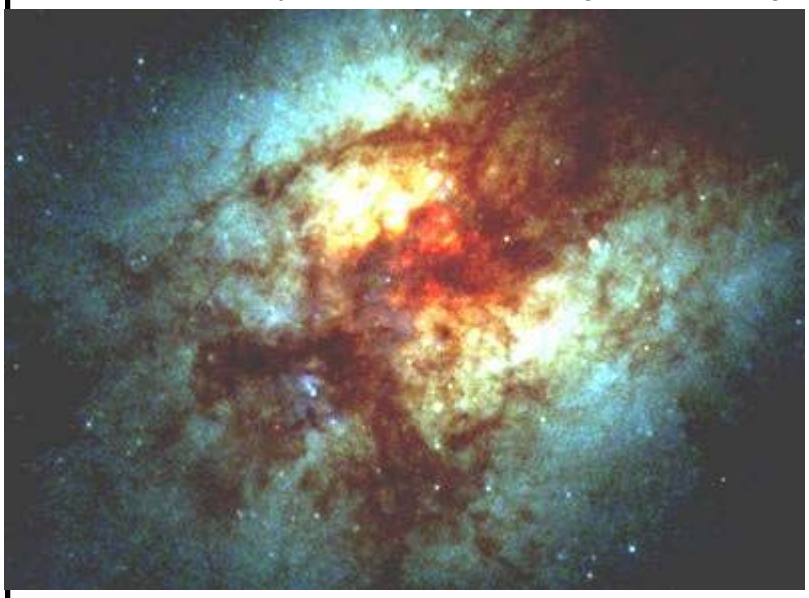
The clusters are so compact, however, that even at their moderate distance they look to Hubble like brilliant single stars. Astronomers know the clusters are not stars because they are much brighter than a star would be at that distance, 250 million light-years away in the constellation Serpens.

The star birth frenzy is happening in a very small region, about 5,000 light-years across (about 5 percent of the Milky Way's diameter), where the gas and dust is very dense. There is as much gas in that tiny region as there is in the entire Milky Way Galaxy.

"This is star birth in the extreme," said astronomer Christine D. Wilson of McMaster University in Hamilton, Ontario, Canada, and the leader of the study. "Our result implies that very high star-formation rates are required to form supermassive star clusters. This is a nearby look at a phenomenon that was common in the early universe, when many galaxies were merging."

Wilson's team obtained measurements of the masses and ages for 14 of the clusters, which allowed them to more accurately estimate the masses and ages for all the clusters. The observations revealed two populations of star clusters. One population is less than 10 million years old; the second, 70 to 500 million years old. Clusters in the younger group are more massive than those in the older group.

Wilson doesn't know whether the flurry of star birth occurred at two different epochs or at a continuous frantic pace and perhaps they are not seeing the intermediate-age population. She does know that the starburst was fueled by a collision between two galaxies that began about 700 million years ago. The effects of the merger have stretched out over hundreds of millions of years.



The team's results appeared in the April 20 issue of the Astrophysical Journal. The finding is based on new observations with Hubble's Advanced Camera for Surveys and on a previous study by the Near Infrared Camera and Multi-Object Spectrometer. The Advanced Camera observations, taken in visible light in August 2002, revealed the large cluster population and produced ages for the older grouping of clusters. The near infrared camera study snapped images of the younger cluster population.

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From Thunderstorms to Solar Storms…

by Patrick L. Barry

When severe weather occurs, there's a world of difference for people on the ground between a storm that's overhead and one that's several kilometers away. Yet current geostationary weather satellites can be as much as 3 km off in pinpointing the true locations of storms. A new generation of weather satellites will boost this accuracy by 2 to 4 times. The first in this new installment of NOAA's Geostationary Operational Environmental Satellites series, called GOES-N, was launched May 24 by NASA and Boeing for NOAA (National Oceanic and Atmospheric Administration). (A new polar-orbiting weather satellite, NOAA-18, was launched May 2005.)

Along with better accuracy at pinpointing storms, GOES-N sports a raft of improvements that will enhance our ability to monitor the weather—both normal, atmospheric weather and "space weather." "Satellites eventually wear out or get low on fuel, so we've got to launch new weather satellites every few years if we want to keep up the continuous eye on weather that NOAA has maintained for more than 30 years now," says Thomas Wrublewski, liaison officer for NOAA at NASA's Goddard Space Flight Center.Currently, GOES-N is in a "parking" orbit at 90° west longitude over the equator. For the next 6 months it will remain there while NASA thoroughly tests all its systems. If all goes well, it will someday replace one of the two active GOES satellites—either the eastern satellite (75°W) or the western one (135°W), depending on the condition of those satellites at the time. Unlike all previous GOES satellites, GOES-N carries star trackers aboard to precisely determine its orientation in space. Also for the first time, the storm-tracking instruments have been mounted to an "optical bench," which is a very stable platform that resists thermal warping. These two improvements will let scientists say with 2 to 4 times greater accuracy exactly where storms are located. Also, X-ray images of the Sun taken by GOES-N will be about twice as sharp as before. The new Solar X-ray Imager (SXI) will also automatically identify solar flares as they happen, instead of waiting for a scientist on the ground to analyze the images. Flares affect space weather, triggering geomagnetic storms that can damage communications satellites and even knock out city power grids. The improved imaging and detection of solar flares by GOES-N will allow for earlier warnings. So for thunderstorms and solar storms alike, GOES-N will be an even sharper eye in the sky.

New GOES-N satellite launches, carrying an imaging radiometer, an atmospheric sounder, and a collection of other space environment monitoring instruments.

Find out more about GOES-N at goespoes.gsfc.nasa.gov/goes . Also, for young people, the SciJinks Weather Laboratory at scijinks.nasa.gov now includes a printable booklet titled "How Do You Make a Weather Satellite?" Just click on Technology.

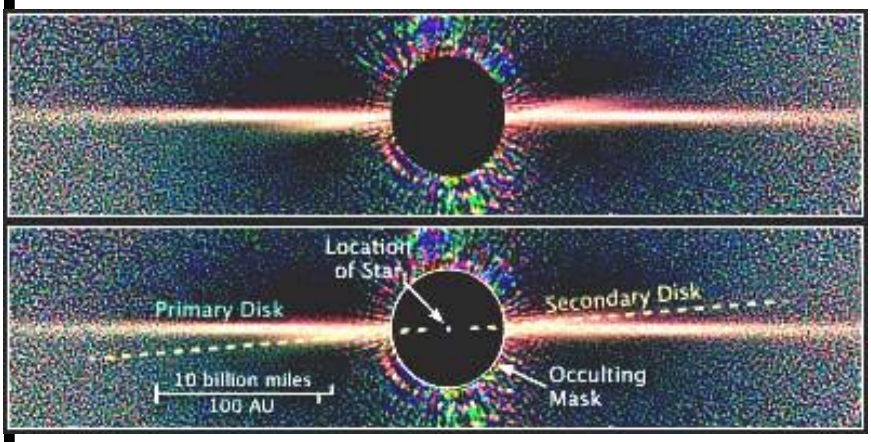
This article was provided by the Jet Propulsion Laboratory, California Institute of Technology, under a contract with the National Aeronautics and Space Administration.

Star's Second Dusty Disc Hints at Giant Planet

NewScientist.com, David Shiga

A nearby star, Beta Pictoris, is surrounded by two dusty discs – not one - a newly released image from the Hubble Space Telescope reveals. The tilt of the second disc with respect to the first suggests it was formed by a giant planet.

In 1984, Beta Pictoris became the first star known to be orbited by a dusty disc of debris, called a circumstellar disc. Discs are now known or suspected around more than 100 stars. Stars quickly clear dust away from their vicinity by the force of their radiation, so the presence of a dusty disc suggests collisions between asteroids or comets are replenishing it.



The newly released image was made by combining dozens of images taken with the Hubble Space Telescope's Advanced Camera for Surveys (ACS), which has recently broken down (see Hubble's key camera stops working). The raw images were shot by the ACS in October 2003, and astronomers have been processing them to bring out faint details.

Astronomers had previously seen what appeared to be a warp in the disc, and a study in 2000 suggested the warp could actually be a second disc that was tilted with respect to the first.

"With the extra imaging processing, we were able to definitively show that this warp is a visual blend of two separate discs," says David Golimowski of Johns Hopkins University in Baltimore, Maryland, US, who led the new study.

Tilted orbits

The newly imaged disc is smaller than the main disc, suggesting it lies closer to the star, and it is tilted by 4° with respect to the main disc. Astronomers believe it formed after a giant planet between 1 and 20 times the mass of Jupiter was scattered out of the main disc by gravitational interactions with other bodies there.

The researchers believe the planet's gravity then pulled small rocky or icy bodies out of the main disc and into the plane of its orbit. There, they collided to generate the dust in the second disc.

"The finding suggests that planetary systems could be forming in two different planes," says Golimowski. If that is the case, then our own solar system is not so odd, with each planet's orbit tilted slightly with respect to the others. Mercury's orbit is tilted by 7° compared to that of the Earth, for example.

And there may be even more discs around Beta Pictoris. Infrared images taken from the Keck II Observatory in 2002 suggest there is a third disc that is tilted by 14° with respect to the main disc – but in the opposite direction to the second disc. This one is too close to the star to be detected by Hubble, but it is also thought to be caused by an unseen planet.

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Pluto's Newest Moons Named Hydra and Nix

By Ker Than, Space.com

The International Astronomical Union has officially christened Pluto's two newest satellites Nix and Hydra. The tiny satellites were discovered by the Hubble Space Telescope last May and are believed to have been formed from the same giant impact that carved out Charon, Pluto's third satellite, discovered in 1978.

The names were proposed this spring by the team that discovered the satellites. Before the satellites received their official names, the satellites were called P1 and P2. In Greek mythology, Nyx was the goddess of the night and the mother of Charon, the boatsman who ferried souls across the River Styx into the underworld ruled by Pluto. The IAU changed the spelling to "Nix" after the Egyptian spelling of the goddess to avoid confusion with two asteroids that had already been named "Nyx."

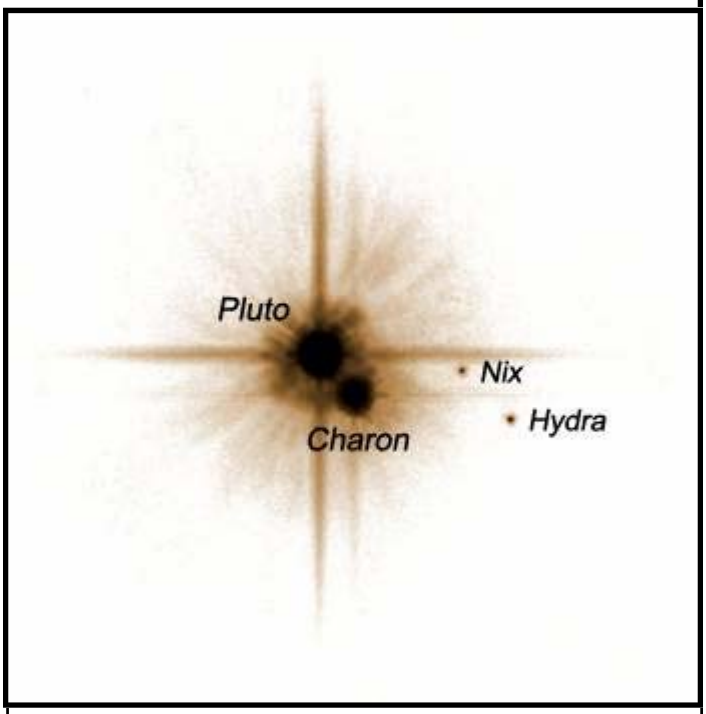
The outermost of Pluto's two new satellites is named after Hydra, the nine-headed mythological serpent that guarded Pluto's realm.

"We thought it was an appropriately scary image to be the guard at the gate," said Alan Stern, an astronomer with the Southwest Research Institute who led the team that initially discovered the satellites.

In addition to their relation to Pluto, the names were chosen because their first initials, "N" and "H," are also the first letters of New Horizons, the NASA spacecraft launched in January towards the Pluto system. The Hubble Space Telescope was providing support for the New Horizons mission when it spotted the tiny satellites. "The 'P' and the 'L' in Pluto are in honor of the Percival Lowell, who instigated the search that resulted in the discovery of Pluto," Stern told SPACE.com. "The 'N' and the 'H' are exactly parallel to honor New Horizons which instigated the search that led us to [the new satellites]."

Stern, who leads the New Horizons mission, also considered the name "Cerberus," the three-headed hound who also guarded the gates to Hades, but rejected it because many people associate Pluto with the Disney cartoon character, and having one object in the system named after a dog was enough.

The new names were reported yesterday on *ScienceNOW.org*, a publication of the American Association for the Advancement of Science. A formal announcement was issued Friday, June 23.



A pair of small moons that NASA's Hubble Space Telescope discovered orbiting Pluto now have official names: Nix and Hydra. Photographed by Hubble in 2005, Nix and Hydra are roughly 5,000 times fainter than Pluto and are about two to three times farther from Pluto than its large moon, Charon, which was discovered in 1978.

Carl Sagan:

One of the saddest lessons of history is this: If we've been bamboozled long enough, we tend to reject any evidence of the bamboozle. The bamboozle has captured us. Once you give a charlatan power over you, you almost never get it back.

Mini Black Holes Might Reveal 5th Dimension

By Ker Than, Space.com

A space telescope scheduled for launch in 2007 will be sensitive enough to detect theoretical miniature black holes lurking within our solar system, scientists say. By doing so, it could test an exotic five-dimensional theory of gravity that competes with Albert Einstein's General Theory of Relativity. That is, of course, if the tiny black holes actually exist.

The idea, recently detailed online in the journal *Physical Review D*, is being proposed by Charles Keeton, a physicist at Rutgers University in New Jersey, and Arlie Petters of Duke University in North Carolina.

Branes

The Randall-Sundrum braneworld model, named after the scientists who created it, states that the visible universe is a membrane embedded within a larger universe, like a strand of seaweed floating in the ocean. Unlike the universe described by General Relativity—which has three dimensions of space and one of time—the braneworld universe contains an extra fourth dimension of space for a total of five dimensions.

If the braneworld theory is true, it would "upset the applecart," Petters said. "It would confirm that there is a fourth dimension to space, which would create a philosophical shift in our understanding of the natural world."

The braneworld theory predicts the existence of tiny black holes seeded throughout the universe, remnants of the Big Bang. Thousands of them should exist in our solar system. General Relativity, in contrast, predicts that such primordial black holes evaporated long ago. The researchers predict that braneworld black holes are about the size of an atomic nucleus but have masses similar to that of a tiny asteroid.

Gamma ray ripples

Petters and Keeton say their theory is testable. The mini-black holes should warp the fabric of space-time differently from other types of black holes—those of stellar-mass and the supermassive variety—due to their close association with the fifth dimension. Light, specifically gamma-rays, should be distorted differently when they whiz past braneworld black holes compared to conventional black holes. "Our calculations show that braneworld black holes will give you a certain ripple in the gamma rays that would be different from general relativity," Petters told *SPACE.com*. The researchers think that the Gamma-ray Large Space Telescope (GLAST) scheduled for launch in 2007 should be sensitive

Black Hole Booted from Galaxy

By Selby Cull, skypub.com

A black hole now zipping through Ursa Major might have been dropkicked out of the galactic disk by an asymmetrical supernova, astronomers reported in the June 10th *Astrophysical Journal*.
The black hole and its small companion star were spotted in 2000 and sparked astronomers' interest because of their location in the galactic halo: more than 5,000 light-years above the galaxy's disk. Stars in this area tend to be ancient leftovers from the galaxy's early years, low in metals, which to an astronomer means any element heavier than helium.

But when a team led by Jonay González Hernández (Astrophysics Institute of the Canary Islands) turned the 10-meter Keck II telescope on the black hole and its companion star, they found something unexpected: heavy elements. The small star orbiting the black hole is soaked in heavy elements – even more-so than our Sun.

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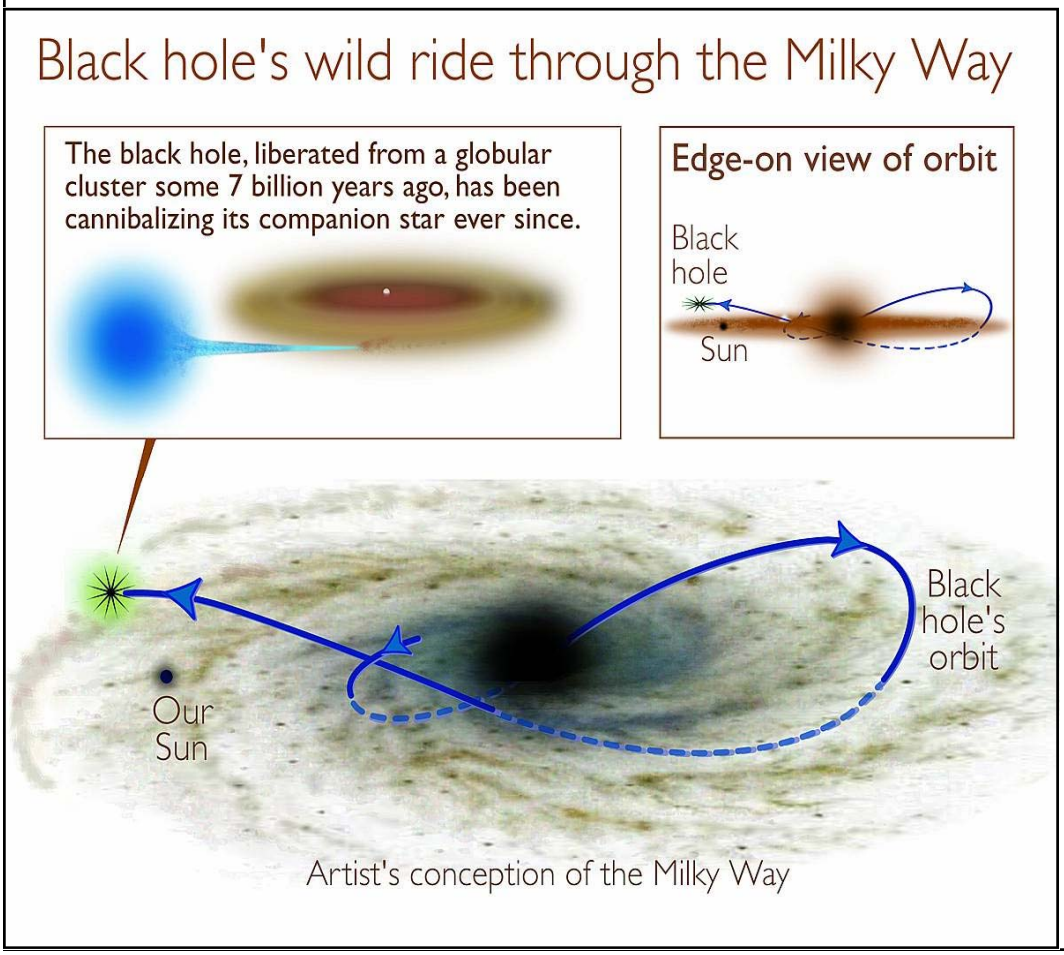
“The secondary star has an iron and metal content too high compared to stars in the galactic halo,” says González Hernández. “Despite its present location, the metal content may suggest that the system formed in the galactic disk.”

If so, González Hernández and his colleagues speculate that the system might have been blasted out of the galactic disk when the more massive star in the binary went supernova, leaving behind a black hole and dragging its metal-rich companion along with it. But this couldn’t have been any regular supernova. To propel the system, the supernova would have been asymmetrical, like a cosmic sneeze expelling vast amounts of junk in one direction.

Such a kick would have simultaneously spewed matter or neutrinos (ghostly particles that carry energy away from the core), created the black hole, and tossed the entire system out of the galaxy’s disk at about 180 kilometers per second (400,000 miles per hour). The asymmetrical kick idea was proposed years ago to explain the bizarre motions of some neutron stars, hurtling through the galaxy at speeds of up to 500 km/sec. This is only the second black hole that researchers think might have received a similar kick. "This is an interesting system,” says Christopher Fryer, an astrophysicist at Los Alamos National Laboratory who has spent years modeling asymmetrical supernovae. "I think the results have interesting implications for our understanding of kicks. We still don’t know what is producing them.”

The supernova kick is just one hypothesis, though. González Hernández has proposed an alternative involving stellar shrapnel. If the system formed in the halo, then the supernova that created the black hole might have splattered its companion with newly formed metals, making an old halo star look relatively young.



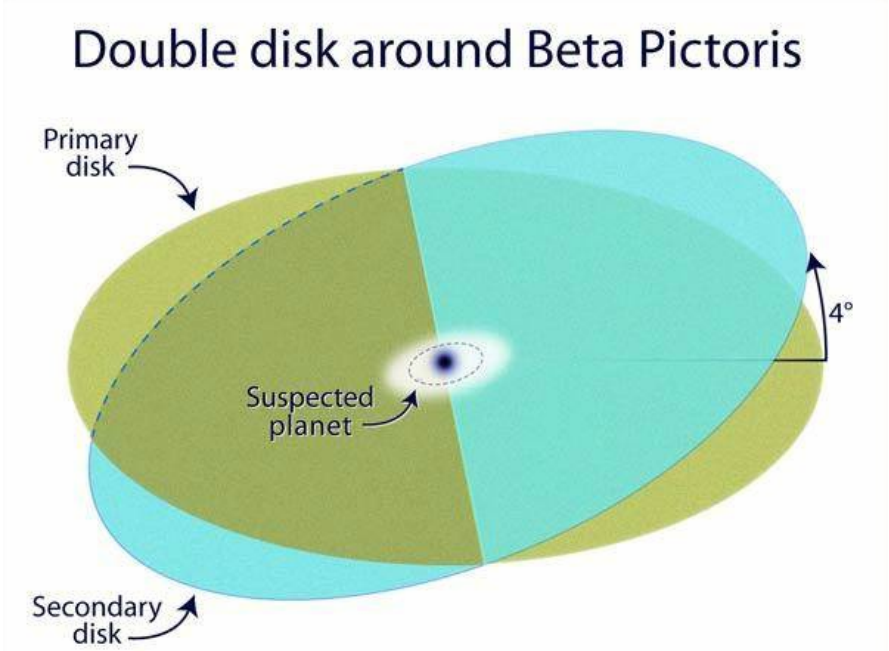
"This would be the first such case,” says Garik Israelian (Astrophysics Institute of the Canary Islands), who was a co-author on the study. “But I think the system was kicked out from the galactic disk. This mechanism is more likely.”

The astronomers may be able to test the two hypotheses by comparing the chemical abundances of lighter elements in the companion star to those in the galactic disk and halo.

(Continued from page 5)

Kamikaze comets

The Hubble images also show the second disc is relatively red, suggesting the dust particles are even smaller than suspected. Finer dust is more quickly blown away from the star, so its abundance in the star's vicinity means that "the rate of its production must be very, very rapid," Golimowski told **New Scientist**.



This fine dust could come from the frequent collisions between planetary building blocks. But it could also come from comets being thrown into Beta Pictoris itself, he says. The comets would evaporate, leaving only gas and dust behind.

Evidence for this process around Beta Pictoris dates back to the late 1980s. That was when astronomers first saw signs of evaporated metals in the star's spectrum, which were attributed to comets vaporising near the star.

(Continued from page 3)

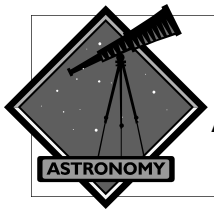
Although the new Hubble image showcases Arp 220 in visible light, the galaxy shines brightest in infrared light. In fact, Arp 220 is called an ultra-luminous infrared galaxy (ULIRG). ULIRGs are the products of mergers between galaxies, which can create firestorms of star birth. Starlight from the new stars heats the surrounding dust, causing the galaxies to glow brilliantly in infrared light.

Only a small amount of visible light escapes through the dust-enshrouded galaxy. If astronomers had an unobstructed view of Arp 220 in visible light, the galaxy would shine 50 times brighter than our Milky Way Galaxy because of the light from its massive clusters and associated star formation.

Arp 220 shares a kinship with other interacting galaxies, such as the well-known Antennae galaxies. Both are the products of galactic mergers. The merging process in Arp 220, however, is farther along than in the Antennae. In fact, said Wilson, one cannot even see the two galaxies that combined to make up Arp 220. Radio data show two objects 1,000 light-years apart that may represent the cores of the original galaxies.

The galaxy will continue to manufacture star clusters until it exhausts all of its gas, which at the current rate will happen in about 40 million years. This may seem like a long time, but it is practically a blink of an eye for a process occurring on a galactic scale. Then Arp 220 will look like the elliptical galaxies seen today, which have little gas. Some of the giant clusters — those that are now 100 million years old — will still be there.

The galaxy is the 220th object in Halton Arp's Atlas of Peculiar Galaxies.



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