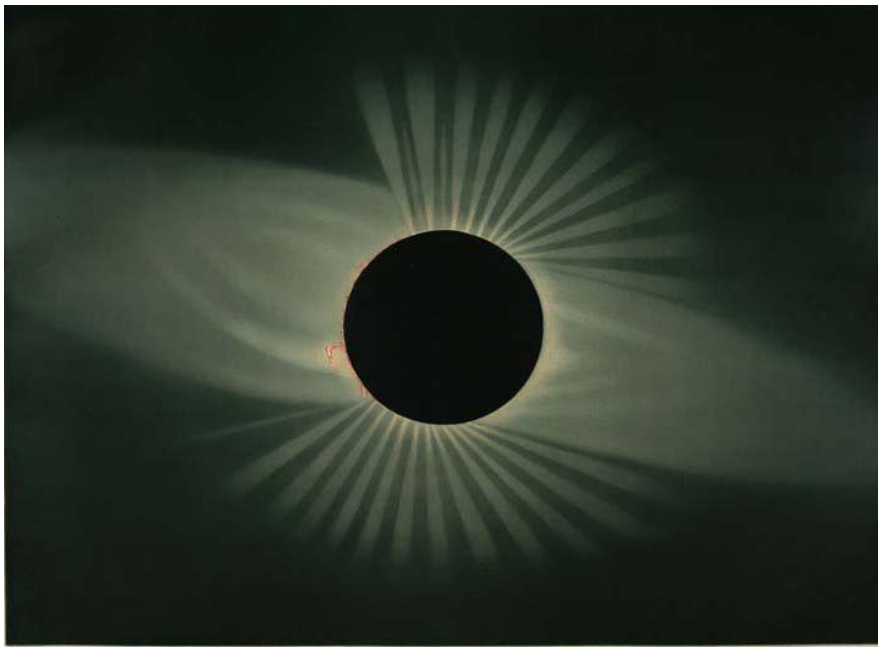
ECLIPSE
NEWSLETTER



The Eclipse Newsletter is dedicated to increasing the knowledge of Astronomy, Astrophysics, Cosmology and related subjects.

VOLUMN 1 NUMBER 6
SEPTEMBER - OCTOBER 2017

PLEASE SEND ALL PHOTOS, QUESTIONS AND REQUST FOR ARTICLES TO
pestrattonmcag@gmail.com

MCAO PUBLIC NIGHTS AND FAMILY NIGHTS.

The general public and MCAO members are invited to visit the Observatory on select Monday evenings at 8PM for Public Night programs. These programs include discussions and illustrated talks on astronomy, planetarium programs and offer the opportunity to view the planets, moon and other objects through the telescope, weather permitting. Due to limited parking and seating at the observatory, admission is by reservation only.

Public Night attendance is limited to adults and students 5th grade and above. If you are interested in making reservations for a public night, you can contact us by calling 302-654-6407 between the hours of 9 am and 1 pm Monday through Friday. Or you can email us any time at KimGreenmcao@gmail.com or mtcuba@physics.udel.edu. The public nights will be presented even if the weather does not permit observation through the telescope. The admission fees are $3 for adults and $2 for children. There is no admission cost for MCAO members, but reservations are still required. If you are interested in becoming a MCAO member, please see the link for membership. We also offer family memberships.

Family Nights are scheduled from late spring to early fall on Friday nights at 8:30PM. These programs are opportunities for families with younger children to see and learn about astronomy by looking at and enjoying the sky and its wonders. It is meant to teach young children from ages 6-12 about astronomy in simple terms they can really understand. Reservations are required and admission fees are $3 for adults and $2 for children.

MCAO WEB SITE IS

mountcuba.org

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ASTRONOMICAL TERMS DEFINED:

Nebula - is an interstellar cloud of dust, hydrogen, helium and other ionized gases.

Supernova - an astronomical event that occurs during the last stellar evolutionary stages of a massive star's life, whose dramatic and catastrophic destruction is marked by one final titanic

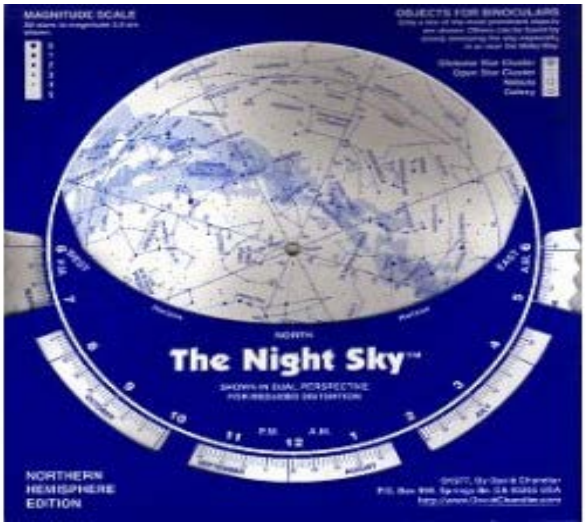
explosion. This causes the sudden appearance of a "new" bright star, before slowly fading from sight over several weeks or months.

globular cluster - is a spherical collection of stars that orbits a galactic core as a satellite. Globular clusters are very tightly bound by gravity, which gives them their spherical shapes and relatively high stellar densities toward their centers.

Planetesimal - A widely accepted theory of planet formation, the so-called planetesimal hypotheses, the Chamberlin–Moulton planetesimal hypothesis and that of Viktor Safronov, states that planets form out of cosmic dust grains that collide and stick to form larger and larger bodies. When the bodies reach sizes of approximately one kilometer, then they can attract each other directly through their mutual gravity, aiding further growth into moon-sized protoplanets.

HOW TO FIND CONSTELLATIONS

Step 1. Purchase a Star Chart as shown below. Mt. Cuba Astronomical Observatory sells this one for $4.00.



Step 2. Orient the Star Chart. You will notice there are two sides to the chart. One side is for viewing the sky to the North. The other side is for viewing to the South. Let's start with the side for the North. You will notice that the white part of the chart rotates. At the bottom, you will see months. Above the month is the date and above that the time. The month and date will rotate so now line them up with the time you are ready for viewing. Simply look at the chart to pick out the object then look up at the sky. Compare the stars on the star chart and the stars you see in the night sky**.** 3. To view South, turn the chart over and turn around to face South.

CONSTELLATIONS AND MESSIER OBJECTS.

ED'S NOTE: THE CONSTELLATION AND MESSIER SECTIONS OF THE EXLIPSE NEWSLETTER.

The selections I use for the Eclipse Newsletter are not always the easiest ones to find or see with the unassisted eye. Their selection is based more on the reader learning of their existence along

with some information about them. I include the Star Chart for those who have a telescope capable of viewing them as well as an area free enough of light pollution to do so.

DELPHIUS SEPTEMBER

Delphinus constellation is in the northern sky. It is one of the smallest constellations. Its name means “the dolphin” in Latin. The constellation represents the dolphin sent by the sea god Poseidon to find Amphitrite, the nereid he wanted to marry.

Delphinus is not easy to find or view with the eye alone.

Stars

Delphinus does not have any bright stars; its brightest star is of magnitude 3.8. The main asterism in Delphinus is Job's Coffin, formed from the four brightest stars: Alpha, Beta, Gamma, and Delta Delphini. Alpha and Beta Delphini are named Sualocin and Rotanev, respectively. When read backwards, they read as Nicolaus Venator, the Latinized name of Palermo Observatory's former director, Niccolò Cacciatore. However, Delphinus is in a rich Milky Way star field.

Deep-sky objects

Because it is in a rich Milky Way star field, Delphinus has several deep-sky objects. NGC 6891 is a planetary nebula of magnitude 10.5 and one more notable planetary nebula is NGC 6905 or the Blue Flash nebula. NGC 6934 is a globular cluster of magnitude 9.75. At a distance of about 185,000 light-years, the globular cluster NGC 7006 is extremely remote. It is also fairly dim at magnitude 11.5.

CONSTELLATION AQUARIUS
OCTOBER

Aquarius is a constellation of the zodiac, situated between Capricornus and Pisces Its name is Latin for "water-carrier" or "cup-carrier", a representation of water. Aquarius is one of the oldest of the recognized constellations along the zodiac (the Sun's apparent path). It was one of the 48 constellations listed by the 2nd century astronomer Ptolemy, and it remains one of the 88 modern constellations. It is found in a region often called the Sea due to its profusion of constellations with watery associations such as Cetus the whale, Pisces the fish, and Eridanus the river.

At apparent magnitude 2.9, Beta Aquarii is the brightest star in the constellation.

Stars

Despite both its prominent position on the zodiac and its large size, Aquarius has no particularly bright stars, its four brightest stars being less than magnitude 2.However, recent research has shown that there are several stars lying within its borders that possess planetary systems.

The two brightest stars, Alpha and Beta Aquarii, are luminous yellow supergiants, of spectral types G0Ib and G2Ib respectively, that were once hot blue-white B-class main sequence stars 5 to 9 times as massive as the Sun. The two are also moving through space perpendicular to the plane of the Milky Way. Just shading Alpha, Beta Aquarii is the brightest star in Aquarius with an apparent magnitude of 2.91. It also has the proper name of Sadalsuud. Having cooled and swollen to around 50 times the Sun's diameter, it is around 2200 times as luminous as the Sun. It is around 6.4 times as massive as the Sun and around 56 million years old. Sadalsuud is 540 ± 20 light-years from Earth. Alpha Aquarii, also known as Sadalmelik, has an apparent magnitude of 2.94. It is 520 ± 20 light-years distant from Earth, and is around 6.5 times as massive as the Sun and 3000 times as luminous. It is 53 million years old.

Planetary systems. Twelve exoplanet systems have been found in Aquarius as of 2013. Gliese 876, one of the nearest stars to Earth at a distance of 15 light-years, was the first red dwarf star to be found to possess a planetary system. It is orbited by four planets, including one terrestrial planet 6.6 times the mass of Earth. The planets vary in orbital period from 2 days to 124 days. 91

Aquarii is an orange giant star orbited by one planet, 91 Aquarii b. The planet's mass is 2.9 times the mass of Jupiter, and its orbital period is 182 days. Gliese 849 is a red dwarf star orbited by the first known long-period Jupiter-like planet, Gliese 849 b. The planet's mass is 0.99 times that of Jupiter and its orbital period is 1,852 days

WHAT ARE THE MESSIER OBJECTS?

The Messier objects are a set of over 100 astronomical objects first listed by French astronomer Charles Messier in 1771. Messier was a comet hunter, and was frustrated by objects which resembled but were not comets, so he compiled a list of them, in collaboration with his assistant Pierre Méchain, to avoid wasting time on them. The number of objects in the lists he published reached 103, but a few more thought to have been observed by Messier have been added by other astronomers over the years.

For a list of Messier objects:

https://en.wikipedia.org/wiki/List of Messier objects

Messier 1 (M1)

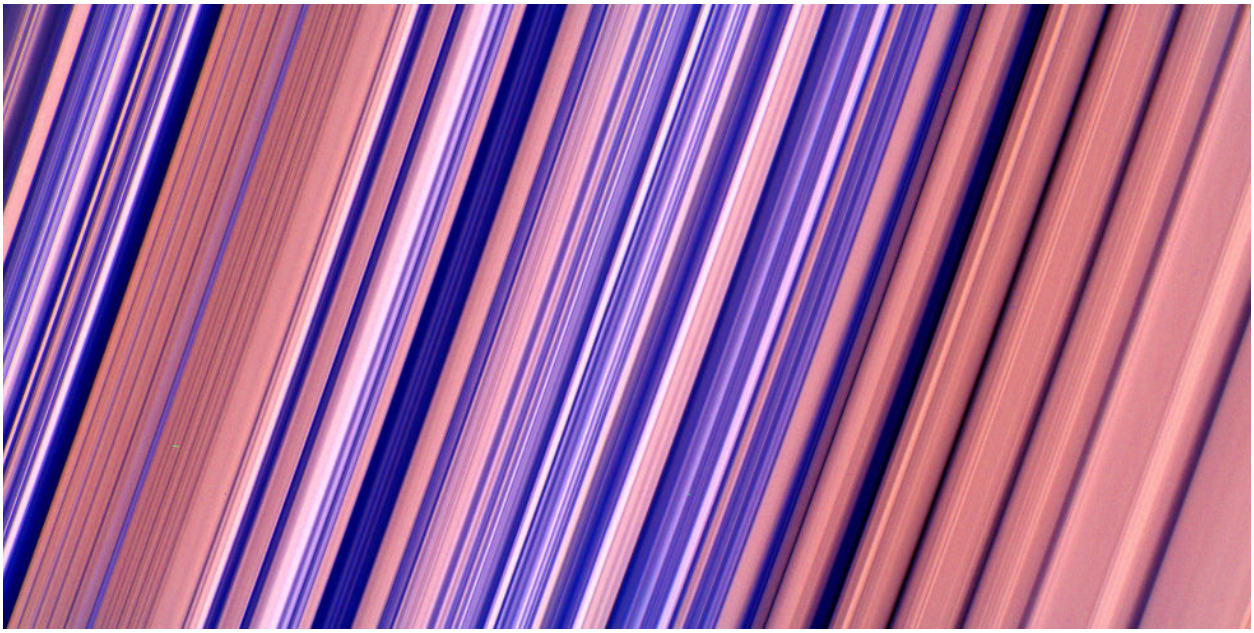
Messier 1 (NGC 1952), also known as the Crab Nebula, is a supernova remnant in Taurus constellation. It has an apparent magnitude of 9.0 and is approximately 6,300 light years distant.

Messier 2 (M2)

Messier 2 (NGC 7089) is a globular cluster in Aquarius constellation. It has a visual magnitude of 7.5 and is 36,000 light years distant from Earth.

THESE ARE THE HIGHEST RESOLUTION PHOTES OF SATURNS RINGS EVER TAKEN.

Cassini is still wowing us.



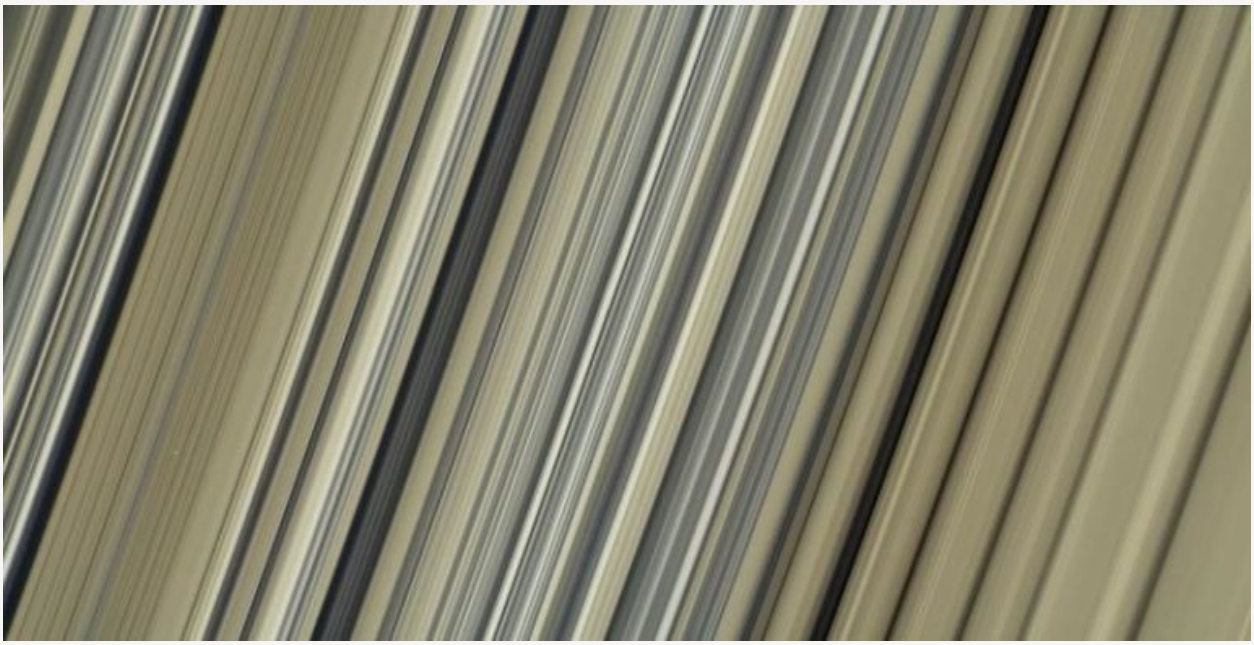
By David Grossman

Sep 8, 2017

NASA has released the highest-resolution color images of Saturn's rings to date, coming from of the inner-central part of the planet's B ring. The image above and the natural color image below were taken by the Cassini spacecraft on July 17.

In the picture above, "blue colors represent areas where the spectrum at visible wavelengths is less reddish (meaning the spectrum is flatter toward red wavelengths), while red colors represent areas that are spectrally redder (meaning the spectrum has a steeper spectrum toward red wavelengths)," according to the space agency.

The image is a mosaic of a sunlit area of Saturn's rings that lies somewhere between 61,300 and 65,600 miles from Saturn's center. The agency has also taken a natural color composite, which uses images taken with red, green and blue spectral filters.



The pale tan color is rarely seen, as it is generally not perceptible with the naked eye in telescope views. The ringlets seen here are part of an "irregular structure" of the B ring, NASA says. Radio occultations from Cassini, which dove in between the the rings and Saturn for the first time in April, show that the features of the rings in these photos have extremely sharp boundaries at a scale so small that the spacecraft's camera could not capture them.

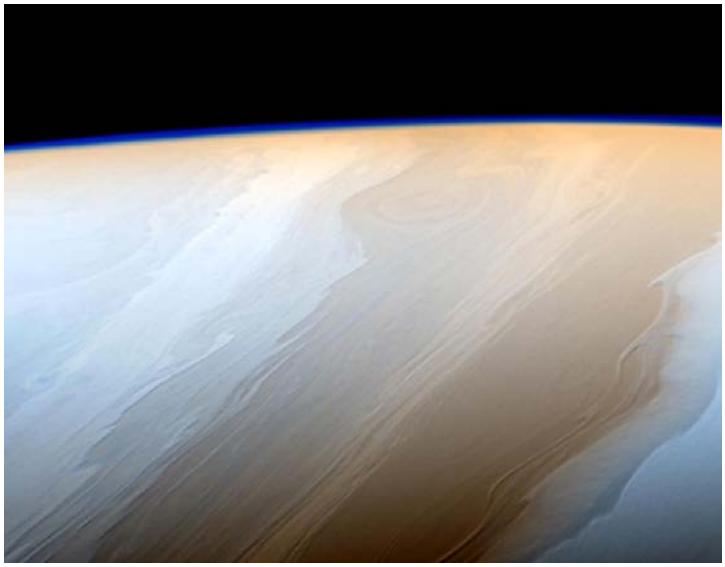
It's Cassini's last stand, as the craft is finishing up what NASA calls its "Grand Finale." On September 15, Cassini itself will fly into Saturn for certain destruction. It's been 19 years since the spacecraft launched, but as these pictures show, Cassini isn't quite done yet.

Source: NASA

Rare GIF of a Dying Star Will Make You Rethink Your Existence.

The Hubble Telescope recently celebrated its 27th birthday, and in those years it has given us an incredible look at the vast world we live in. Case in point: a rare peek at a dying star.
From 2002 to 2006, Hubble captured close-up images of an enormous star named V838 Moncerotis, which sits 20,000 light-years away from Earth. Back then, the star emitted a powerful flash of light that illuminated the dust and gas that surrounded it.
"Hubble's exceptionally sharp focus of V838 Mon offered a ring-side seat at the slow death of the star and excited astrophysicists with the chance to study the physics of the light, matter and microscopic dust of the interstellar medium," writes The Conversation, which offers more details about the life of the star and the cause of that light flash.

Saturn's wavy clouds pop in NASA Cassini image.



Cassini got a good look at Saturn's artistic cloud patterns.

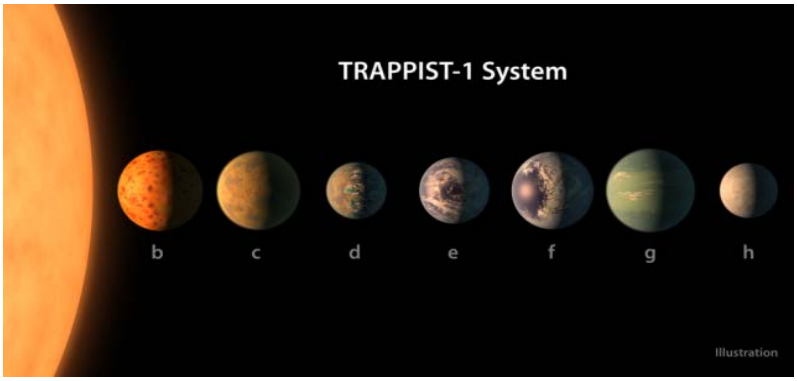
NASA/JPL-Caltech/Space Science Institute
Saturn is a wild and wonderful place. NASA released a Cassini spacecraft image on Monday that brings home just how different the ringed planet is from our blue and watery Earth. The view shows a close-up look at undulating waves of clouds.

NASA has likened Saturn's look to a watercolor painting before. The space agency dropped some more poetry this time. "Clouds on Saturn take on the appearance of strokes from a cosmic brush thanks to the wavy way that fluids interact in Saturn's atmosphere."

NASA says the patterns come from the movement of clouds at different latitudes. Turbulence occurs where the bands touch, which in turn causes the fetching waves. This false-color picture is compiled from Cassini images taken in mid-May.

Cassini isn't long for this solar system. The spacecraft is reaching the end of its mission and will plunge into Saturn's atmosphere for its scheduled doom in September.

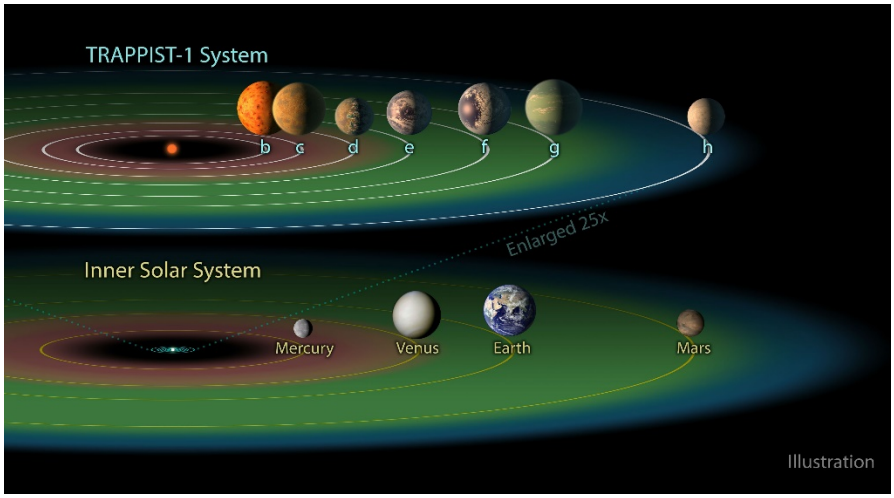
TRAPPIST-1 SOLAR SYSTEMT



TRAPPIST-1, also designated as 2MASS J23062928-0502285, is an ultra-cool dwarf star that is slightly larger but much more massive than the planet Jupiter, located 39.5 light-years (12.1 pc) from the Sun in the constellation Aquarius. Seven temperate terrestrial planets have been detected orbiting the star, a larger number than detected in any other planetary system. A study released in May 2017 suggests that the tightly packed exoplanets avoid colliding with one another due to orbits that are harmoniously resonant and, as a result, are stable for very long times.

Astronomers first discovered three Earth-sized planets orbiting the dwarf star in 2015. A team led by Michaël Gillon (fr) at the University of Liège in Belgium detected the planets using transit photometry with the Transiting Planets and Planetesimals Small Telescope (TRAPPIST) at the La Silla Observatory in Chile. On 22 February 2017, astronomers announced four additional exoplanets around TRAPPIST-1. This work used the NASA *Spitzer Space Telescope* and the

Very Large Telescope at Paranal, among others, and brought the total number of planets to seven, of which three are considered to be within its habitable zone. The others could also be habitable as they may possess liquid water somewhere on their surface.



The orbital motions of the TRAPPIST-1 planets form a complex chain with three-body Laplace-type resonances linking every member. The relative orbital periods (proceeding outward) approximate whole integer ratios of 24/24, 24/15, 24/9, 24/6, 24/4, 24/3, and 24/2, respectively, or nearest-neighbor period ratios of about 8/5, 5/3, 3/2, 3/2, 4/3, and 3/2 (1.603, 1.672, 1.506, 1.509, 1.342, and 1.519). This represents the longest known chain of near-resonant exoplanets, and is thought to have resulted from interactions between the planets as they migrated inward within the residual protoplanetary disk after forming at greater initial distances.

The resonant chain has been shown to be necessary to keep the tightly packed system stable for long timescales, and the tight correspondence between whole number ratios in orbital resonances and in music theory has made it possible to convert the system's motion into music.

Formation of the planetary system. Current understanding.

For centuries, astronomers and philosophers wondered how our solar system and its planets came to be. As telescopes advanced and space probes were sent out to explore, we learned more and more about our solar system, which gave us clues to how it might have taken shape.

But were our ideas right?

We could only see the result of planet formation, not the process itself. And we had no other examples to study. Even with the knowledge gained about our solar system, we were left to wonder, are there other planetary systems out there, and did they form like ours? Discoveries made by the Hubble Space Telescope are helping us fill in key pieces to the puzzle of how planets form.

According to our current understanding, a star and its planets form out of a collapsing cloud of dust and gas within a larger cloud called a nebula. As gravity pulls material in the collapsing

cloud closer together, the center of the cloud gets more and more compressed and, in turn, gets hotter. This dense, hot core becomes the kernel of a new star.

Meanwhile, inherent motions within the collapsing cloud cause it to churn. As the cloud gets exceedingly compressed, much of the cloud begins rotating in the same direction. The rotating cloud eventually flattens into a disk that gets thinner as it spins, kind of like a spinning clump of dough flattening into the shape of a pizza. These "circumstellar" or "protoplanetary" disks, as astronomers call them, are the birthplaces of planets.

As a disk spins, the material within it travels around the star in the same direction. Eventually, the material in the disk will begin to stick together, somewhat like household dust sticking together to form dust bunnies. As these small clumps orbit within the disk, they sweep up surrounding material, growing bigger and bigger. The modest gravity of boulder-sized and larger chunks starts to pull in dust and other clumps. The bigger these conglomerates become, the more material they attract, and the bigger they get. Soon, the beginnings of planets — "planetesimals," as they are called — are taking shape.

In the inner part of the disk, most of the material at this point is rocky, as much of the original gas has likely been gobbled up and cleared out by the developing star. This leads to the formation of smaller, rocky planetesimals close to the star. In the outer part of the disk, though, more gas remains, as well as ices that haven't yet been vaporized by the growing star. This additional material allows planetesimals farther from the star to gather more material and evolve into giants of ice and gas.

As each planetesimal grows bigger, it starts clearing out the material in its path, snatching up nearby, slow-moving rubble and gas while gravitationally tossing other material out of its way. Eventually, the debris in its path thins out and the planetesimal has a relatively clear lane of traffic around its star.

Hundreds of these planetesimals are forming at the same time, and inevitably they meet up. If their paths cross at just the right time and they're moving fast enough relative to each other, SMASH! — they collide, sending debris everywhere. But if they slowly meander toward one other, gravity can gently draw them together. They form a union, merging into a larger object. If the participants are farther apart, they might not physically interact but their gravitational encounter can pull each body off course. These wayward objects start to cross other lanes of traffic, setting the stage for additional collisions and other meetings of the rocky kind.

After millions of years, countless encounters between these planetesimals have cleared out much of the disk's debris and have built up much larger — and many fewer — objects that now dominate their regions. A planetary system is reaching maturity.

Piecing the evidence together.

How do we know all this? In part, because Hubble's exceptional vision has uncovered evidence in the disks around stars. This evidence helps to piece together the story of how planets form.

For more information http://hubblesite.org/

Until recently, we had only one planetary system — our own — to study in our attempt to understand how planets form. But in less than two decades, the Hubble Space Telescope has worked with other telescopes to open a window onto the mystery of planet formation. Hubble's ability to peer into nearby nebulae and to probe the regions around neighboring stars has shown us planetary systems under construction, the conditions planets form in, and even a planet orbiting another star. Hubble's discovery of a planet circling Fomalhaut replaced speculation with direct evidence that some of the strange features it has seen in disks could be caused by developing planets. Hubble's revelations have sometimes confirmed our ideas and sometimes showed us things we never imagined, all the while helping us better understand how planets form.

UPCOMING STAR PARTIES

For more information on DAS STAR PARTIES, visit the mountcuba.org web site. Select Delaware Astronomical Society DAS.

Select Events at top and then STAR PARTIES.