The Spectrogram

Newsletter for the Society of Telescopy, Astronomy, and Radio

May 2014

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S*T*A*R
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May Meeting

The next meeting of S*T*A*R will be held on Thursday, May 1 at 8 p.m. at Monmouth Museum. Our speaker will be STAR member Sarbmeet Kanwal, who will discuss what has been learned about the large-scale structure of the universe from the recent Red Shift Galaxy Surveys and the CMB surveys. He will show results of simulations of how our universe could have evolved into clusters of galaxies following the big bang.

Calendar

June 5, 2014 – S*T*A*R business meeting

April Meeting Minutes

By Rob Nunn

S*T*A*R met on Thursday, April 3 at Monmouth Museum in Lincroft. The meeting began at 8 pm, with 35 people in attendance. There were two new attendees. The meeting was chaired by Vice President Rob Nunn. Rob presented the evening's agenda, reviewed the topics for upcoming meetings, then introduced the guest speaker.

Professor Jerry Sellwood is a member of the faculty in the department of physics and astronomy at Rutgers University. His main interests are structure and evolution of galaxies, their formation, and their dark matter content. The title of his talk was “Spirals in Galaxies.”

Professor Spellwood began by noting that the spiral arms of Whirlpool Galaxy were first observed by Lord Rosse about 1850, and that until now no one has known the reason that many galaxies exhibit a spiral structure. Galaxies show many types of spiral structures, some better organized than others, and some with bars. Astronomers have observed that galaxies without gas do not have a spiral structure. But images in blue and infrared wavelengths show that stars are not associated with the distribution of gas, so they conclude that gas is not directly responsible for the spiral structure. Astronomers further observe a differential rotation rate of stars within an arm. Those further out from the center take longer to complete an orbit.

In his research to investigate structure of galaxies, Professor Sellwood simulates the motions of stars within a galaxy. His simulations are based on Newton's laws of gravity and mechanics, and include a representation of dark matter He has run simulations of galaxies with as many as 500 million stars. His early simulations showed development of spiral arms, but those arms disintegrated after about ten rotations. He found that when he added gas to a galaxy, which causes the stars to lose energy, the spirals became stable. Since that discovery, he has worked to understand the reason gas causes stability.

His first indication of the explanation came from observation of the results of his simulations, which showed a pattern in the arms called a density wave. He then used mathematical models to study those patterns. By introducing a perturbation of the uniform motion of stars, he saw spirals develop, but then disappear. The disturbance dies out because it is damped by resonance: a wave reflected back toward the center of the galaxy causes a small amount of random motion of the stars, which eventually destroys the spiral pattern. Gas prevents the ringing motion within an arm, thus preserving the pattern. He illustrated the effect by ringing a metal rod. By placing one end of the rod on his shoe, the ringing was damped.

With a proposed explanation in hand, Professor Sellwood then looked for confirmation through observation of the motion of stars in the Milky Way. Results from the European satellite Hipparchos include measurements of star motion except for motion toward Earth. The Geneva-Copenhagen Survey of 14,000 stars provided the motions toward Earth. Using these measurements, he observed an effect called resonance fraying in the stars of the Hyades Stream. Resonance fraying confirms his prediction of the damping caused by gas. Professor Sellwood is about to publish his theory of the explanation of the spiral structure of galaxies.

Members of the audience were very excited to hear this preview of Professor Sellwood's results, and showed their interest with many questions that continued even after the break began.

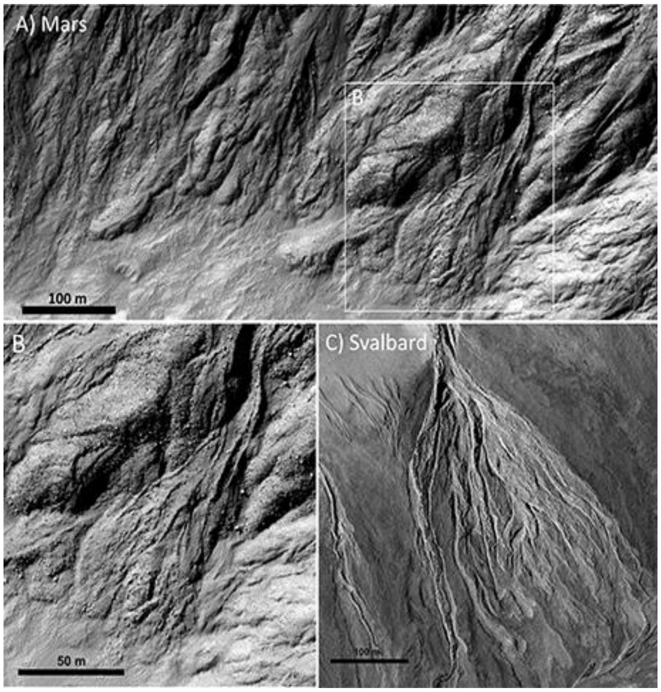
Following the break, Ken Legal presented events of the month. Mars will reach opposition on April 8. With good skies one should be able to observe markings on the surface. A lunar eclipse about 2 am on April 15 will be the first of a tetrad of eclipses spaced four to six months apart.

In new business and announcements, Rob noted that Ken Legal, George Zanetakos, and Mike Kozic have offered to serve as the nominating committee for new officers. The star party held April 2 at Mill Lake Elementary school was a good success, with about 8 club members bringing their scopes. There will be a star party at Matawan High School on April 9.

The drawing for 50/50 was won by Arturo Cisneros, and the meeting concluded about 10:20 pm.

Traces of recent water on Mars

Apr 25, 2014



This photo shows debris flowing on Mars. Credit: NASA/JPL/UofA for HiRISE

New research has shown that there was liquid water on Mars as recently as 200,000 years ago. The results have been published in *Icarus* (*International Journal for Solar System Studies*). "We have discovered a very young crater in the southern mid-latitudes of Mars that shows evidence of liquid water in Mars' recent past," says Andreas Johnsson at the University of Gothenburg, Sweden.

The southern hemisphere of Mars is home to a crater that contains very well-preserved gullies and debris flow deposits. The geomorphological attributes of these landforms provide evidence that they were formed by the action of liquid water in geologically recent time.

Evidence of liquid water

When sediment on a slope becomes saturated with water, the mixture may become too heavy to remain in place, leading to a flow of debris and water as a single-phase unit. This is called a debris flow. Debris flows on Earth often cause significant material destruction and even human casualties, when they occur in built-up areas. During a debris flow, a mixture of stones, gravel, clay and water moves rapidly down a slope. When the sediment subsequently stops, it displays characteristic surface features such as lobate deposits and paired levees along flow channels.

It is these landforms that Andreas Johnsson has identified on Mars. The research group has been able to compare the landforms on Mars with known debris flows on Svalbard with the aid of aerial photography and field studies. The debris flows on Mars provide evidence that liquid water has been present in the region.
"Our fieldwork on Svalbard confirmed our interpretation of the Martian deposits. What surprised us was that the crater in which these debris flows have formed is so young," says Andreas Johnsson of the Department of Earth Sciences, University of Gothenburg.

After the ice age

Crater statistics allowed Andreas Johnsson and his co-authors to determine that the age of the crater to be approximately 200,000 years. This means that the crater was formed long after the most recent proposed ice age on Mars, which ended around 400,000 years ago.

"Gullies are common on Mars, but the ones which have been studied previously are older, and the sediments where they have formed are associated with the most recent ice age. Our study crater on Mars is far too young to have been influenced by the conditions that were prevalent then. This suggests that the meltwater-related processes that formed these deposits have been exceptionally effective also in more recent times," says Andreas Johnsson, principal author of the article.

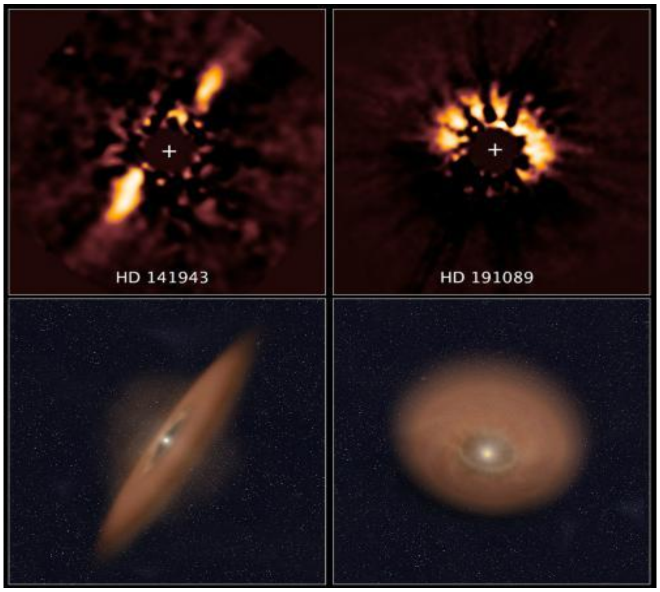
Impact in wet ground

The study crater is situated in the mid-latitudes of Mars' southern hemisphere, superposed on what is known as the rampart ejecta of a nearby larger crater. A rampart ejecta display a "flowerlike" form around the host crater, and scientists have interpreted this as being the result of an impact in wet or ice-rich ground.

"My first thought was that the water that formed these debris flows had come from preserved ice within the rampart ejecta. But when we looked more closely, we didn't find any structures such as faults or fractures in the crater that could have acted as conduits for the meltwater. It is more likely that the water has come from melting snow packs, when the conditions were favorable for snow formation. This is possible, since the orbital axis of Mars was more tilted in the past than it is today," says Andreas Johnsson.

Astronomical forensics uncover planetary disks in Hubble archive

Apr 24, 2014



The two images at top reveal debris disks around young stars uncovered in archival images taken by NASA's Hubble Space Telescope. The illustration beneath each image depicts the orientation of the debris disks. Credit: NASA/ESA, R. Soummer, Ann Feild (STScI)

(Phys.org) —Astronomers using NASA's Hubble Space Telescope have applied a new image processing technique to obtain near-infrared scattered light photos of five disks observed around young stars in the Mikulski Archive for Space Telescopes database. These disks are telltale evidence for newly formed planets.

If astronomers initially miss something in their review of data, they can make new discoveries by revisiting earlier data with new image processing techniques, thanks to the wealth of information stored in the Hubble data archive. This is what Rémi Soummer, of the Space Telescope Science Institute (STScI) in Baltimore, Md., and his team recently did while on a hunt for hidden Hubble treasures.

The stars in question initially were targeted with Hubble's Near Infrared Camera and Multi-Object Spectrometer (NICMOS) based on unusual heat signatures obtained from NASA's Spitzer Space Telescope and the Infrared Astronomical Satellite that flew in 1983. The previous data provided interesting clues that dusty disks could exist around these stars. Small dust particles in the disks might scatter light and therefore make the disks visible. But when Hubble first viewed the stars between 1999 and 2006, no disks were detected in the NICMOS pictures.

Recently, with improvements in image processing, including algorithms used for face-recognition software, Soummer and his team reanalyzed the archived images. This time, they could unequivocally see the debris disks and even determine their shapes.

The NICMOS instrument, which began collecting data in 1997, has been so cutting-edge that ground-based technology only now is beginning to match its power. Because Hubble has been in operation for almost 24 years, it provides a long baseline of high-quality archival observations.

"Now, with such new technologies in image processing, we can go back to the archive and conduct research more precisely than previously possible with NICMOS data," said Dean Hines of STScI.

"These findings increase the number of debris disks seen in scattered light from 18 to 23. By significantly adding to the known population and by showing the variety of shapes in these new disks, Hubble can help astronomers learn more about how planetary systems form and evolve," said Soummer.

The dust in the disks is hypothesized to be produced by collisions between small planetary bodies such as asteroids. The debris disks are composed of dust particles formed from these grinding collisions. The tiniest particles are constantly blown outward by radiation pressure from the star. This means they must be replenished continuously though more collisions. This game of bumper cars was common in the solar system 4.5 billion years ago. Earth's moon and the satellite system around Pluto are considered to be collisional byproducts.

"One star that is particularly interesting is HD 141943," said Christine Chen, debris disk expert and team member. "It is an exact twin of our Sun during the epoch of terrestrial planet formation in our own solar system."

Hubble found the star exhibits an asymmetrical, edge-on disk. This asymmetry could be evidence the disk is being gravitationally sculpted by the tug of one or more unseen planets.
"Being able to see these disks now also has let us plan further observations to study them in even more detail using other Hubble instruments and large telescopes on the ground," added Marshall Perrin of STScI.

"We also are working to implement the same techniques as a standard processing method for NASA's upcoming James Webb Space Telescope," said STScI teammate Laurent Pueyo. "These disks will also be prime targets for the Webb telescope."
Soummer's team has just begun its work. They next will search for structures in the disks that suggest the presence of planets.

Are you a S*T*A*R Member?

S*T*A*R meets the first Thursday of each month, except July and August, at 8:00 p.m. at Monmouth Museum on the campus of Brookdale Community College in Lincroft, NJ. Meetings usually include a presentation of about one hour by a guest speaker, a break for refreshments and socializing, a description of interesting objects to view, and a discussion of club business.

Memberships:
( )Individual...$35
( ) Family...$45
( ) Student…$15

Name___________________________

Address_________________________

City______________________State___Zip________

Phone__________________________

Email_________________________

Make checks payable to: STAR Astronomy Society, Inc. and mail to P.O. Box 863, Red Bank, NJ 07701

The club owns 8" f/8, 13" f/4.5 and 25" f/5 Dobsonian telescopes which are available for use by members. Because of its large size use of the 25" requires the supervision of two qualified operators. To borrow a telescope or become a qualified operator of the 25", please contact the Vice President.

The officers of S*T*A*R are:
President Kevin Gallagher
Vice President Rob Nunn
Secretary Michelle Paci
Treasurer Arturo Cisneros
Member at Large Dave Britz

In the Eyepiece

Here is a list of objects for this month. This is reproduced from www.skyhound.com with the kind permission of its creator and author of SkyTools Greg Crinklaw.

Object(s)	Class	Con	RA	Dec	Mag
Izar	Multiple Star	Bootes	14h44m59.2s	+27°04'27"	2.4
Xi Boo	Multiple Star	Bootes	14h51m23.4s	+19°06'02"	4.5
44 Boo	Multiple Star	Bootes	15h03m47.4s	+47°39'15"	4.8
M 3	Globular Cluster	Canes Venatici	13h42m11.8s	+28°22'24"	6.3
NGC 5466	Globular Cluster	Bootes	14h05m27.7s	+28°31'49"	9.2
39 Boo	Multiple Star	Bootes	14h49m41.3s	+48°43'15"	5.7
M 53	Globular Cluster	Coma Berenices	13h12m56.2s	+18°09'56"	7.7
Pi 1 Boo	Multiple Star	Bootes	14h40m43.6s	+16°25'06"	4.5
Whirlpool (M51)	Galaxy	Canes Venatici	13h29m52.4s	+47°11'41"	8.9
The Pinwheel (M101)	Galaxy	Ursa Major	14h03m12.5s	+54°20'53"	8.3
NGC 5474 & Co.	Galaxies near M101	Ursa Major	14h05m01.4s	+53°39'45"	11.3
NGC 5529	Galaxy	Bootes	14h15m34.2s	+36°13'35"	12.7
IC 5217	Planetary nebula	Lacerta	22h23m55.7s	+50°58'00"	12.6
NGC 5774 & 5775	Galaxy Pair	Virgo	14h53m42.6s	+03°34'55"	12.8
NGC 5371	Galaxy	Canes Venatici	13h55m39.8s	+40°27'43"	11.5
Hickson 68	Galaxy Group	Canes Venatici	13h53m40.9s	+40°19'41"	10.5
NGC 5634	Globular Cluster	Virgo	14h29m38.1s	-05°58'42"	9.5
NGC 5053	Globular Cluster	Coma Berenices	13h16m28.2s	+17°41'44"	9.0
Arp 84	Interacting Galaxies	Canes Venatici	13h58m38.0s	+37°25'28"	12.1
IC 972	Planetary Nebula	Virgo	14h04m26.0s	-17°13'41"	14.9
UGC 7321	Superthin Galaxy	Com	12h17m34.1s	+22°32'26"	14.1

Coordinates are equinox 2000.0