The Spectrogram

Newsletter for the Society of Telescopy, Astronomy, and Radio

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S*T*A*R
P.O. Box 863
Red Bank, NJ 07701
On the web at:
http://www.starastronomy.org

April Meeting

The next meeting of S*T*A*R will be held on Thursday, April 3 at 8 p.m. at Monmouth Museum. Our speaker will be Jerry Sellwood, a professor in the department of physics and astronomy at Rutgers University. He will discuss "Spirals in Galaxies."   The origin of spirals in galaxies has eluded us for over 150 years. Computer simulations of galaxies have long displayed similar patterns, but even they have proven hard to understand. Professor Sellwood will present a very simplified description of the origin of spirals in simulations, which may be the solution to this long-standing problem

Calendar

April 2, 2014 – Mill Lake star party

April 3, 2014 – S*T*A*R meeting

March Meeting Minutes

By Rob Nunn

S*T*A*R met on Thursday, March 6 at Monmouth Museum. Vice-president Rob Nunn began the meeting at 8:10 p.m. There were about 25 people in attendance. Rob presented the agenda for the meeting, and two new attendees introduced themselves.

Rob then introduced the speaker for the evening, club member George Zanetakos. The title of George's talk was “Imaging the Messier Objects.” George described his early interest in astronomy, beginning with a visit to Hayden Planetarium in New York City as a child. He used a small refractor telescope at his home in Brooklyn, with which he attempted to take images by holding a camera to the eyepiece. He eventually obtained proper imaging equipment and began taking images with film.

George's project to image all the Messier objects began when he made the switch to digital imaging. George uses a DSLR camera for imaging. He explained that imaging with a CCD yields somewhat better results, but is more difficult. His camera is from Canon, and is specialized for astrophotography. Other equipment includes a German equatorial mount with periodic error correction, a 200 mm Cassegrain reflector, a guide scope, an autoguider, and a flattener. The flattener prevents stars from elongating. He emphasized that the most important item is the mount.

The first step in taking an image is to align the telescope with the polar axis. George's mount has a telescope with which he makes an alignment with Polaris. Alignment takes a few minutes. The drift method is more accurate, but slower. In the drift method a star must be tracked for about 10 minutes for azimuth, and another star tracked for elevation. He sets up his camera so that up is Right Ascension and left is Hour Angle. Then he focuses his camera by making the diffraction spikes from a first magnitude star as large as possible. The auto guider must be focused and calibrated. Calibration tells the autoguider how fast the stars move. The aoutoguider must be aimed within about five degrees of the scope.

George explained that the process of producing an image consists of a number of steps. The final image is achieved by computer processing of four types of images: lights, darks, flats, and dark flats. A light is produced by a normal exposure. A dark is used to reduce noise in the light, and is taken with the same settings (ISO, time, temperature) as the light, but with no light entering the camera. A flat is used to reduce vignetting. It is taken with a twilight sky, and has to be taken only once. A dark flat is used to reduce noise in the flat. Since a dark must match settings of a light, George has created a library of darks. For a selection of ISO settings, exposure times, and temperatures, he took 12 dark exposures, then combined those into a master dark.

The software he uses for image processing is Image Plus, whose price is about $250. There are free packages, and more expensive ones. He uses stacked lights. Stacking gives cleaner results. George gave a demonstration of the process, using a set of lights, darks, flats, and dark flats, and then color balancing the image. He quickly generated a beautiful image. He finished his presentation by showing some of his spectacular Messier images.

As an act of financial support for the club, George donated a set of 10 CDs containing his images of the 110 Messier objects. Club members bought four of the disks at a price of seven dollars.

Following a break, Ken Legal presented objects of the month. He described an occultation of the first magnitude star Regulus that will occur in the early morning of March 20. In this very rare event, the shadow of an asteroid will cross the north-eastern parts of New Jersey. The star will be occulted for a period of up to 14 seconds.

The club then discussed new business and heard announcements. Dan Pontone suggested that the club web site have a list of the year's talks. Currently only the next talk is listed. He also suggested that the club publicize the speaker for the May meeting. He said the speaker is well known, and the club could probably achieve a large turnout for the meeting. The club decided to hold a Messier Marathon at Dorbrook Recreation Area on Friday, March 28. Mike Kozic suggested that a committee be formed to investigate possible purchases of equipment using proceeds from sale of the 25-inch telescope. Russ Drum announced that a star party will be held at Mill Lake Elementary School on Wednesday, April 2.

The meeting was adjourned about 10:20 p.m.

The search for seeds of black holes

Mar 27, 2014 by Whitney Clavin

(Phys.org) —How do you grow a supermassive black hole that is a million to a billion times the mass of our sun? Astronomers do not know the answer, but a new study using data from NASA's Wide-field Infrared Survey Explorer, or WISE, has turned up what might be the cosmic seeds from which a black hole will sprout. The results are helping scientists piece together the evolution of supermassive black holes—powerful objects that dominate the hearts of all galaxies.

Growing a black hole is not as easy as planting a seed in soil and adding water. The massive objects are dense collections of matter that are literally bottomless pits; anything that falls in will never come out. They come in a range of sizes. The smallest, only a few times greater in mass than our sun, form from exploding stars. The biggest of these dark beasts, billions of times the mass of our sun, grow together with their host galaxies over time, deep in the interiors. But how this process works is an ongoing mystery.

Researchers using WISE addressed this question by looking for black holes in smaller, "dwarf" galaxies. These galaxies have not undergone much change, so they are more pristine than their heavier counterparts. In some ways, they resemble the types of galaxies that might have existed when the universe was young, and thus they offer a glimpse into the nurseries of supermassive black holes.

In this new study, using data of the entire sky taken by WISE in infrared light, up to hundreds of dwarf galaxies have been discovered in which buried black holes may be lurking. Infrared light, the kind that WISE collects, can see through dust, unlike visible light, so it's better able to find the dusty, hidden black holes. The researchers found that the dwarf galaxies' black holes may be about 1,000 to 10,000 times the mass of our sun—larger than expected for these small galaxies.

"Our findings suggest the original seeds of supermassive black holes are quite massive themselves," said Shobita Satyapal of George Mason University, Fairfax, Va. Satyapal is lead author of a paper published in the March issue of *Astrophysical Journal*.

Daniel Stern, an astronomer specializing in black holes at NASA's Jet Propulsion Laboratory, Pasadena, Calif., who was not a part of the new study, says the research demonstrates the power of an all-sky survey like WISE to find the rarest black holes. "Though it will take more research to confirm whether the dwarf galaxies are indeed dominated by actively feeding black holes, this is exactly what WISE was designed to do: find interesting objects that stand out from the pack."

The new observations argue against one popular theory of black hole growth, which holds that the objects bulk up in size through galaxy collisions. When our universe was young, galaxies were more likely to crash into others and merge. It is possible the galaxies' black holes merged too, accumulating more mass. In this scenario, supermassive black holes grow in size through a series of galaxy mergers.

The discovery of dwarf galaxy black holes that are bigger than expected suggests that galaxy mergers are not necessary to create big black holes. Dwarf galaxies don't have a history of galactic smash-ups, and yet their black holes are already relatively big. Instead, supermassive black holes might form very early in the history of the universe. Or, they might grow harmoniously with their host galaxies, feeding off surrounding gas.

"We still don't know how the monstrous black holes that reside in galaxy centers formed," said Satyapal. "But finding big black holes in tiny galaxies shows us that big black holes must somehow have been created in the early universe, before galaxies collided with other galaxies."

Other authors of the study include: N.J. Secrest, W. McAlpine and J.L. Rosenberg of George Mason University; S.L. Ellison of the University of Victoria, Canada; and J. Fischer of the Naval Research Laboratory, Washington.

WISE was put into hibernation upon completing its primary mission in 2011. In September 2013, it was reactivated, renamed NEOWISE and assigned a new mission to assist NASA's efforts to identify the population of potentially hazardous near-Earth objects. NEOWISE will also characterize previously known asteroids and comets to better understand their sizes and compositions.

First sightings of solar flare phenomena confirm 3-D models of space weather

Mar 27, 2014

Scientists have for the first time witnessed the mechanism behind explosive energy releases in the Sun's atmosphere, confirming new theories about how solar flares are created.

New footage put together by an international team led by University of Cambridge researchers shows how entangled magnetic field lines looping from the Sun's surface slip around each other and lead to an eruption 35 times the size of the Earth and an explosive release of magnetic energy into space.

The discoveries of a gigantic energy build-up bring us a step closer to predicting when and where large flares will occur, which is crucial in protecting the Earth from potentially devastating space weather. The study is published in *The Astrophysical Journal*.

While solar flares have long been a spectacular reminder of our star's power, they are also associated with Coronal Mass Ejections (CMEs) – eruptions of solar material with a twisted magnetic structure flying out of the Sun and into interplanetary space.

Space weather such as CMEs has been identified as a significant risk to the country's infrastructure by the UK's National Risk Register. Late last year The UK's MET Office announced it would set up a daily space weather forecast to work with the USA's Space Weather Prediction Center (SWPC).

The paper's lead author, Dr Jaroslav Dudik, Royal Society Newton International Fellow at the University of Cambridge's Centre for Mathematical Sciences, said: "We care about this as during flares we can have CMEs and sometimes they are sent in our direction. Human civilisation is nowadays maintained by technology and that technology is vulnerable to space weather. Indeed, CMEs can damage satellites and therefore have an enormous financial cost."

"They can also threaten airlines by disturbing the Earth's magnetic field. Very large flares can even create currents within electricity grids and knock out energy supplies."

One such event hit the Earth before technology was as integrated into human civilization as it is now, but still had a marked effect. In 1859 the Carrington storm made night skies so bright that newspapers could be read as easily as in daylight and telegraph systems caught fire.

Knowing the standard scientific models are right is therefore very important. The standard 3D model of solar flares has shown that they occur in places where the magnetic field is highly distorted.

In these places, the magnetic field lines can continuously reconnect while slipping and flipping around each other. In doing so, new magnetic structures are created.

Long before the flare the magnetic field lines are un-entangled and they appear in a smooth arc between two points on the photosphere (the Sun's visible surface) – areas called field line footpoints.

In a smooth, none-entangled arc the magnetic energy levels are low but entanglement will occur naturally as the footpoints move about each other. Their movement is caused as they are jostled from below by powerful convection currents rising and falling beneath the photosphere.

As the movement continues the entanglement of field lines causes magnetic energy to build up.

Like a group of straight cords which has been twisted, the lines will hold the energy until it becomes too great and then will release it, "straightening" back to the lower energy state.

Co-author Dr Helen Mason, Head of the Atomic Astro-Physics Group at the University of Cambridge, said: "You build the stress slowly until a point where they are no longer sustainable. The field lines say they have had enough and 'ping', they go back to something simple."

That "ping" creates the solar flare and CME. The word "ping" belies its power of course. Temperatures in the hotspots of the ejection can reach almost 20 million Degrees Celsius.

The theory remained unconfirmed until Dudik was reviewing footage of the Sun for an unrelated project last year.

It is no surprise it has taken so long to make the discovery. The technology that created the video is part of the Solar Dynamics Observatory (SDO) satellite mission which was only launched in 2010 by NASA.

It watches the Sun in the ultra-violet with the Atmospheric Imaging Assembly (AIA) capturing ultra-high-definition images every 12 seconds.

The final piece of the theoretical jigsaw was put in place in 2012 by French scientists – a paper published just six days before the flare occurred. Dudik admits that the serendipity the discovery is hard to ignore. But in science, fortune favours the prepared: "Suddenly I knew what I was looking at," he said.

What Dudik witnessed was the ultra-violet dance caused by the magnetic field lines slipping around each other, continuously "unzipping" and reconnecting as the footpoints of the flare loops move around on the surface. But during the flare, the footpoint slipping motion is highly ordered and much faster than the random motions entangling the field before the flare.

Dudik's observations were helped by the sheer size of the flare he was looking at – it could encompass 35 Earths. Not only that, the flare was of the most energetic kind, known as an X Class flare, and it took around an hour to reach its maximum.

If it had happened in a smaller flare, the slipping motion might not have been visible, even with NASA's technology to help. Although only seen in an X Class flare to date, the mechanism might well be something which happens in all flares, said Dudik: "But we are not yet certain."

The importance of seeing the evidence of theory cannot be underestimated said Dr Mason: "In recent years there have been a lot of developments theoretically but unless you actually tie that down with observations you can speculate widely and move further away from the truth, not closer, without knowing it."

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
Y CVn	Variable Star	Canes Venatici	12h45m07.8s	+45°26'25"	4.9
Black Eye	Galaxy	Coma Berenices	12h56m43.9s	+21°41'00"	9.3
Sombrero	Galaxy	Virgo	12h39m59.3s	-11°37'22"	9.1
Downtown Virgo & the M87 Jet!	Galaxy Cluster	Virgo	12h26m12.2s	+12°56'45"	9+
M 106	Galaxy	Canes Venatici	12h18m57.5s	+47°18'14"	9.1
M 108	Galaxy	Ursa Major	11h11m31.3s	+55°40'31"	10.9
M65	Galaxy	Leo	11h18m55.8s	+13°05'32"	10.2
M 66	Galaxy	Leo	11h20m15.1s	+12°59'22"	9.6
Owl	Planetary Nebula	Ursa Major	11h14m46.1s	+55°01'07"	12.0
NGC 4631 (The Whale)	Galaxy	Canes Venatici	12h42m07.8s	+32°32'27"	9.7
NGC 4656	Galaxy	Canes Venatici	12h43m58.2s	+32°10'09"	11.4
NGC 4244	Galaxy	Canes Venatici	12h17m29.5s	+37°48'26"	10.8
NGC 4013	Galaxy	Ursa Major	11h58m31.5s	+43°56'51"	12.3
NGC 4762	Galaxy	Virgo	12h52m55.9s	+11°13'57"	11.3
NGC 4236	Galaxy	Draco	12h16m41.8s	+69°28'10"	10.1
Hickson 61	Galaxy Group	Coma Berenices	12h12m23.9s	+29°10'40"	11.1
NGC 3607	Galaxy	Leo	11h16m54.8s	+18°03'06"	10.9
Focus On Gliese 433.1	White Dwarf Star	Ursa Major	11h37m05.1s	+29°47'58"	12.5
Antennae/Ring Tail	Galaxy	Corvus	12h01m52.8s	-18°51'54"	10.9
NGC 4490	Galaxy	Canes Venatici	12h30m36.7s	+41°38'27"	10.1
NGC 4361	Planetary Nebula	Corvus	12h24m30.8s	-18°47'05"	10.3
NGC 4027	Galaxy	Corvus	11h59m30.1s	-19°16'05"	11.7
NGC 4094	Galaxy	Corvus	12h05m53.9s	-14°31'36"	12.7
NGC 4782 & 4783	Galaxy	Corvus	12h54m35.8s	-12°34'06"	12.4
NGC 4462	Galaxy	Corvus	12h29m21.2s	-23°09'59"	12.8
NGC 3987	Galaxy	Leo	11h57m20.9s	+25°11'42"	13.8
Siamese Twins	Interacting Galaxy Pair	Virgo	12h36m34.4s	+11°14'18"	11.7+12.1
NGC 3628	Galaxy	Leo	11h20m16.9s	+13°35'14"	10.3
NGC 4565	Galaxy	Coma Berenices	12h36m21.1s	+25°59'13"	10.6
Abell Galaxy Cluster 1631	Galaxy	Corvus	12h52m52.6s	-15°24'47"	13.3
Palomar 4	Globular Cluster	UMa	11h29m16.0s	28°58'24"	14.2
Abell 35	Planetary Nebula	Hydra	12h53m34.2s	-22°52'17"	12.0