The Objective View February 2003

Newsletter of the Northern Colorado Astronomical Society

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Next Meeting: February 6 7:30 pm

City of Fort Collins Lighting

Kraig Bader and Ted Shepard

NCAS Business at 7 pm

Meeting directions
Discovery Science Center
703 East Prospect Rd, Fort Collins
http://www.dcsm.org/index.html
In Fort Collins, from the intersection of College Ave and Prospect Rd, head East about 1/2 mile. See the Discovery Center sign to the South. Enter the West Wing at the NE corner. From I-25, take Exit 268, West to Lemay Ave, continue West 1/2 mile, see Discovery Center on the left.

NCAS Star Party Dates
February 21, 22, 28
Cactus Flats site is on undeveloped parcel of prairie about 6 miles West of Briggsdale. Take Colo Hwy 14 East from I-25 (Exit 269). Go 19 miles East to Ault. Continue 18 miles East of Ault. At County Rd 65 (Milepost 170), turn North, go one mile. Site is through the wire gate on the right, no road, close gate and set up. Beware of the cactus. Our standard nights are the weekend of the New Moon, sometimes a weekend before and after. The site is now officially wheelchair accessible, but there are no facilities so bring essentials. Call **Tom Teters, starmon@jymis.com,** with questions about star party status or dates, 482-5702 or 482-0807.

Discovery Science Center Starwatching

February 7	6:30 pm
March 7	6:30 pm
April 4	7:30 pm
May 9	8:00 pm

Longmont Astronomical Society 1st Quarter Moon Public Viewing Nights, Flanders Park
February 8

Other Events

Little Thompson Observatory Star Night, Berthoud
February 21 Star Night 7 – 10 pm
http://www.starkids.org

Cheyenne Astronomical Society
February 21 Cheyenne Botanical Garden
http://users.sisna.com/mcurran

Open House, Chamberlain Observatory, dusk to 10 PM
February 8 303 871 5172
http://www.du.edu/~rstencel/Chamberlin/

Longmont Astronomical Society
February 20, Longmont Christian School, 550 Coffman St
http://laps.fsl.noaa.gov/cgi/las.cgi

North Sterling Star Party April 26

Destination Mars at Discovery Science Center

Invitation to NCAS Members from Corey Radman

Discovery Science Center is thrilled to announce the world premiere of the traveling exhibit, Destination Mars, built by the Space Science Institute funded in part by the National Aeronautics and Space Administration. In recognition of NCAS's continued support of Discovery Science Center programs we are very excited to be able to invite you to this exclusive opening celebration. This celebration coincides with the February 6 NCAS meeting and we would be honored to include NCAS members in the celebration before the meeting begins.

The NCAS meeting will be held as usual in the Discovery Science Center classroom beginning at 7:00 p.m. The opening party begins in the rest of the museum at 6:00 and runs until 9:00 p.m.

If you plan to attend the exhibit opening, please RSVP to 472-3998 by Tuesday, February 4.

January 9 Program

Understanding Diffraction, by Gerry Reynolds

Gerry sought to understand the limits of optical quality by studying the limits posed by diffraction. He started from classic models of light propagation. He initially viewed the diffraction pattern created at the edge of a shadow as caused by the edge. This took him down an engineering path, can an edge be modified to suppress diffraction. Before his analysis, he hoped some optical element like a radial gradient filter could reduce diffraction. He visualized the classic slit experiment, with light rays passing through a slit and striking a screen. The shadow edges of a slit image are fuzzy and show bands due to diffraction. The divergence of light which has come through a slit can be modeled with a wave model. He began with a classic model of a light wave leaving a slit. The light front is viewed as

a line of point sources. Passing the slit, light behaves as if is is emitted as spherical wavefronts emitted from each point in the line. Cancellation occurs at less than 1 wavelength of the light, and at 1 wavelength the fronts merge to form a new front. However, the spherical propagation at the ends of the line spreads the light and widens the slit image. The sharpness of the shadow is proportional to the wavelength of the light. Gerry visualized another model, with spherical wavefronts converging on a point. These form the Airy disk, with 68% of light energy in a central spot, surrounded by progressively fainter diffraction rings. He wrote software to model the impact of obstructions and edge modifications on the Airy disk distribution. He realized through his modeling that it is best to not to see the Airy disk as the product of the edge. An Airy disk is formed because wave fronts are missing, not because light is passing an edge. Edge manipulation can shift light among the central peak in intensity and the diffraction rings, but the ring diameters can't be improved. Nate Perkins recommended the freeware program Abberator 3.0 for modeling telescope optics. Joe DiVerdi drew an analogy from radio astronomy. It is possible to shift energy from side lobes to the center of an illuminated point, but the central disk is broadened as a result. Gerry closed with a selection of astrophotographs he has taken over years. Most images are prime focus photos with a Taurus astrocamera, Meade 10" LX200, f/6.3 on Ektachrome P1600. He especially enjoyed photographing deep sky objects from our stellar neighborhood like the Pleiades and Double Cluster, Orion nebula and Zeta Orionis region, the Sagittarius Milky Way objects, planetary nebulae including M76 and M27, to globular clusters including M5, M12. Galaxies included the Andromeda system, NGC 891, NGC2683, NGC 2903, M64, M65, M66, M81 & M82. He captured Comet Hyakutake and Comet Hale-Bopp. He has taken a few Moon images. Jan Kok then closed with his Comet Hale-Bopp images with a 105mm lens and barn-door tracker.

NCAS Business
President Jan Kok called the meeting to order. Nominees for officers were Dan Laszlo, President; Max Moe, Vice President; Kimon Berlin, Secretary; Nate Perkins, Treasurer. The slate was elected unopposed, and look forward to the New Year. Don Willson reported his visit to the Observatory Village development, which has minimally shielded colonial light poles like other new developments.

Longmont Amateurs Featured in TV Program Request for Astrophotos

----- Original Message -----
From: "Chris Rock" <starparty@mac.com>

Hello all,

I have two reasons for filling your e-mail box.

First is an update on the "Star Party" documentary. We're in the final edit phase right now and look forward to having a final, produced film in a few months. As we approach the actual release date, we'll better know pricing and distribution details. We're very excited.

Second, we want to open a call for entries for amateur astrophotography. "Star Party" is an excellent forum to showcase the best astrophotography from amateur astronomers. Who needs Hubble? (Well ok, we all do.) The point is, this film is about amateur astronomers. So send us your best.

Please submit low-resolution files initially. We'll select which shots best fit the content and look of "Star Party" and contact you for the high-res photos. Selected photographers will get full credit for their work, of course.

If you're not an astrophotographer, we'd love it if you could forward this e-mail on to someone who is. And if you haven't seen the trailer for "Star Party" yet, head over to our website.

http://homepage.mac.com/starparty/

If you have any questions or requests, please don't hesitate to contact me at this e-mail address. As always, if you don't want to receive e-mails please let me know.

Thanks,
Chris Rock

P.S.--We'll be at Rocky Mountain Star Stare again this year (http://www.rmss.org/rmss/index.htm), with copies of "Star Party" in hand.
Look us up.

Scope for Sale
Coulter 10 inch Dobsonian. Like new. Includes Kellner eyepiece, eyepiece rack, red-dot aiming device, aperture stop, dustcap. $600. Call Gene, 970-568-0545.

Clear Sky Clocks for Colorado
http://cleardarksky.com/csk/prov/Colorado_clocks.shtml

Best Looks

Moon		by Saturn 2/11, by Jupiter 2/15
		by Venus 2/26 & 27, by Mars on 2/24
Mercury		Low in SE, mornings, first week of month
Venus		low in SE predawn
Mars		By Antares in SSE predawn
Jupiter		Opposition Feb 1-2, highest at midnight
	Feb 10	1928 to 1940 Europa occults Ganymede
		2016 to 2025 Europa eclipses Ganymede
Saturn		Visible from early evening through night
Uranus		Obscured by Sun
Neptune		Obscured by Sun

Orion's Trapezium Variable, Theta Ori A, Minimum 2/26
The Westernmost star in the Trapezium is normally as bright as the Easternmost, Component D, magnitude 6.7. The A star is

an eclipsing variable, expected reach minimum about 8th magnitude at 2200 Feb 26, midpoint of minimum at 0020 Feb 27, event ending about 0300.

Forwarded from Randy Moench:
C/2002 Y1 (Jules-Holvorcem)

This one seems to be brightening rapidly too. This post from the comets mailing list:
To: comets-ml@yahoogroups.com

Subject: [comets-ml] 2002 Y1
2002 Y1 is now an easy binocular object. It is quite large and diffuse, and observations made in large apertures may not see the outer coma. On Feb 3.09 I made it 8.7, DC2, dia 8.3' in 20x80B. In the Northumberland refractor (30cm x105) it was a magnitude fainter.

Of course I assume all of you have been out for a look at Comet Neat 2002 V1.

T-minus 7 weeks and counting till the arrival of 2003 Olivia Moench

Randy

From Jim S: Best Moon Site I've Seen:
http://www.moon-phases.com/

On Columbia

I have seen, photographed and video taped four Shuttle re-entries over California, starting with STS-63. A photo of the re-entry of STS-73 is posted at:
http://photos.yahoo.com/bc/rickbaldridge/vwp?.dir=/Astronomy+Stuff&.src=ph&.dnm=STS-73+Columbia+Reentry.jpg&.view=t&.done=http%3a//photos.yahoo.com/bc/rickbaldridge/lst%3f%26.dir=/Astronomy%2bStuff%26.src=ph%26.view=t
(If you have trouble with this long link, go to http://photos.yahoo.com/rickbaldridge and click on "Astronomy Stuff" album, and then the second picture. The Yahoo page was down a few days ago but is working again.)

Believe me, NONE of them show even the slightest indication of brightenings in the trail or small pieces coming off.

Yesterday was a bad day for me (and all of us.) I video-taped the re-entry for Mt. Hamilton, CA and took two photos. Naked-eye, we didn't notice anything too unusual, but I was spending most of my time looking through the video camera viewfinder. We thought we had just seen another spectacular NORMAL re-entry. Only an hour later when I got home did I learn of the tragedy that occurred minutes after we saw the Shuttle go by.

When I looked at my video, there were very faint but definite pieces coming off, with the first piece seen on the video at 5:53:45am PST +/- 1 second. A had made a time-hack as I always do to obtain timings, and this hack was synchronized to WWV. As far as I know at this time, I was the furthest west observer on the re-entry track to get a video. NASA has been given a copy of the tape. They may want the master of course to analyze further. I also took two still photos, one through a 16mm lens that shows the entire visible trace of the Shuttle and BOTH photos show definite brightenings in the trail that corresponde to brightenings the video shows. Again, I have NEVER seen this activity before STS-107. The photos will be scanned today and posted, after I get a copy to NASA.

Bless the families and friends of the Columbia Crew.

Rick Baldridge
Campbell, CA

From Brian Simpson:

I got up about 6:30 this morning wondering if I could see the reentry from SE Fort Collins. I was disappointed to see clouds covering the sky, but they weren't all that thick, and it was warm out, so I got my shoes and coat on and ventured out. I hiked up a hill that gave me a good view of the SW sky at about 6:50. I stayed there until 7:01, but never saw anything through the clouds, and then began hiking back to my house. A minute or so later I heard two muffled booms which I presumed were from a neighborhood south of me. Could it be that the sounds came from way south, as in Texas? Does not seem possible. Can sounds travel farther at high altitude? At the time I didn't pay much attention to them. They didn't sound like gunshots; more like a neighbor being inconsiderate. Shortly afterwards I was back in my house and I turned on the TV. A few minutes later the program was interrupted by a breaking news story that contact with the shuttle had been lost. Moments later came the video footage showing the reason why.
Brian S

Brian,
I was out also about the same time and I also heard the rumble noise. It was like muffled explosions.
Weird!
--Philippe Bridenne

From Brad Jarvis:
As president of the Rocky Mountain Mars Society, I thought it appropriate to use this forum to share some thoughts about yesterday's tragic loss of the space shuttle Columbia and its crew.

It happened that yesterday was the first day of the "Destination Mars" exhibit at the Discovery Center in Fort Collins. Several members of RMMS, including me, were there to set up our table and talk to people about the Mars Society. A friend of mine asked how we could even consider talking to anyone about going to Mars after the loss of the shuttle. After all, seven people just lost their lives, possibly due to a problem with their spacecraft. It

may be months or years before another shuttle flies. But implicit in the question was another: "Is it worth it?" I realized that these questions and the concerns they reflected needed to be addressed now rather than later. During its news conferences, I saw that NASA felt the same way, and had the same answers.

Any endeavor that goes beyond the known and the comfortable, that tries to take humankind to new places and new understanding, has associated risks. The people involved in those endeavors are aware if the risks, and take them willingly. The value of what these people do is defined in a real way by what they risk in doing it, as well as what it can lead to. They know in their hearts that if they are succesful, they will make a positive difference in the lives of people everywhere. They feel very personally the need to explore and to learn that drove humanity to colonize the continents, to discover the physical laws that govern the Universe, and to develop the technologies that enable the world to support a population of billions.

When we talk about going to Mars, we are talking about a step in the expansion of humanity into space. Astronauts have comitted their lives to the endeavor of exploring and utilizing space. The loss of Columbia demonstrates what it truly means to "commit one's life" to something. This is worth talking about at a time like this. We must suffer as few losses as we can. We must forge ahead, knowing that if we don't, the losses will have been, to some extent, in vain. No one in the astronaut corps would think of backing out because of what happened yesterday. If anything, it galvanizes them, and should galvanize the rest of us, to continue in this noble endeavor.

Regards,

Brad Jarvis

President, Rocky Mountain Mars Society

Here are my thoughts:

The best real science since the moon landings has come from unmanned spacecraft. Voyager, Viking, Pathfinder, Galileo, and I am looking forward to Cassini landing on Titan.

After Challenger I absolutely expected another failure. It looks like the failure rate is about 2% for shuttles. I am surprised that Apollo 13 was the worst that happened before, unless you count Apollo 0 catching fire.

What are we getting for our manned space effort? Low earth orbit experiments to see how bad weightlessness is for human health? Enough already. The space station is consuming billions of dollars that could be used to learn something new.

I think we should scrap the manned missions until we have one that can do real science, like exploring Mars. Robots can go to harsher environments, stay there longer, and don't need to come back. Robots can do distant exploring. Go to Europa, go to Pluto.

I work in a semiconductor wafer fab and I see how often our complex equipment fails, destroying wafers but costing no human life. Big expensive high tech machinery breaks, no doubt about it.

If you want to send humans to Mars, I will support that, after we send some more robots. The failure rate for a Mars mission will probably be at least 5%. Is it worth it? It is to some people.

But I do not support sending people to low earth orbit to do junk science that benefits only some politically connected contractor.

I'd like to see 20 years of robot missions followed by a Zubrin-style mission to Mars. And if the financing was private instead of taxes, that would be even better.

Just my opinions.

David Chamness

On Tue, 4 Feb 2003, Dave Chamness wrote:
> Enough already. The space station is consuming billions of dollars
> that could be used to learn something new.

I, too, agree that the science per $ return is better for robotic spacecraft. The reasons for sending people into space are more idealistic, and it is important to review the associated costs and risks, and whether is it worth the costs and risks.

> But I do not support sending people to low earth orbit to do junk
> science that benefits only some politically connected contractor.

However, there are other reasons to support the ISS, such as providing a good-will international project. The ISS is supporting scientists around the world (especially in the former Soviet Union) who would otherwise be unable to have jobs or support their families, and would likely be hired away by other nations to use their expertise for weapons. (Most of the Iraqi scientists were trained elsewhere, such as in the US and Europe.) These ISS scientists are working very cheaply (relative to US costs), and on something positive for the world, while increasing international security. I consider my taxes well spent for those purposes.

And a second point: The margins that contractors make doing NASA work are *substantially* lower than what they make for defense projects. It is the big defense projects, many of which don't make the news, not NASA work, that are the majority of the pork and sweetheart deals being made.

That's not to say that the shuttle/ISS spending shouldn't be reviewed, but the money "wasted" there is a small fraction of what is being spent in space on the Star Wars/ SDI/Missle Defense Shield, and other defense projects that are currently ramping up.

Don't forget the perspective that the ISS/NASA work is only one tree in the whole forest of defense deals being made.

To rephrase what you wrote:
> But I do not support sending people to low earth orbit to do junk
> science that benefits only some politically connected contractor.

I do not support defense projects in low earth orbit to do junk "defense" that benefits only some politically connected contractor.

Andrea

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The Mars Society is taking requests for CCD observations every Thursday night (weather permitting) using their 11" Clestron Nextstar GPS telescope at the Mars Desert Research Station (MDRS) near Hanksville, Utah. I've recently been asked to coordinate the observations for the Society. (See http://www.marssociety.org/news/2003/0104.asp> for an article about the observatory's first light.)

If anyone is interested, you can write me at <astronomy@marssociety.org> for more information.

Regards,

Brad Jarvis

Granted we astronomy buffs follow the space program a lot more closely than the average citizen, but one would think certain media types would at least have clue...

I heard Geraldo Rivera say on FoxNews, "why didn't the Shuttle just remain docked at the Space Station for another couple of weeks." Another Fox report had the Shuttle's altitude at "200,000 miles."

The champion of all was CNN's graphic (see link) stating the Shuttle travels at "18 TIMES SPEED OF LIGHT."

http://evil.minions.com/~bifrost/cnnsucks.jpg

Dave L.

Desert Sunset Star Party - May 1-4, 2003

Registration is now online for the Desert Sunset Star Party. Please check our website (http://chartmarker.tripod.com/sunset.htm) for details about this new star party and to get your registration forms. We have speakers who will talk on a variety of subjects such as identifying stars, supernovae, Mars and the weather in the Southwest. We will have vendors present and door prizes, and a contest for the best Simple Astronomy Tool (SAT). We also have lots to do during the day and have scheduled tours to Mt. Hopkins (Whipple Observatory), BioSphere 2, and the Univ of AZ Mirror Lab. Catered meals will also be available. If you do not have web access, please contact a club member to get the forms. We hope you will be able to join us.

Chart Markers and More
Pat and Arleen Heimann
http://chartmarker.tripod.com

---------- Forwarded message ----------

http://cfa-www.harvard.edu/press/pr0303.html

Harvard-Smithsonian Center for Astrophysics
Press Release No.: 03-03
For Release: January 13, 2003

New Moons Found Around Neptune

Cambridge, MA - A team of astronomers led by Matthew Holman (Harvard-Smithsonian Center for Astrophysics) and JJ Kavelaars (National Research Council of Canada) has discovered three previously unknown moons of Neptune. This boosts the number of known satellites of the gas giant to eleven. These moons are the first to be discovered orbiting Neptune since the Voyager II flyby in 1989, and the first discovered from a ground-based telescope since 1949.

It now appears that each giant planet's irregular satellite population is the result of an ancient collision between a former moon and a passing comet or asteroid. "These collisional encounters result in the ejection of parts of the original parent moon and the production of families of satellites. Those families are exactly what we're finding," said Kavelaars.

The team that discovered these new satellites of Neptune includes Holman and Kavelaars, graduate student Tommy Grav (University of Oslo & Harvard-Smithsonian Center for Astrophysics), and undergraduate students Wesley Fraser and Dan Milisavljevic (McMaster University, Hamilton, Ontario, Canada).

Needle in a Haystack

The new satellites were a challenge to detect because they are only about 30-40 kilometers (18-24 miles) in size. Their small size and distance from the Sun prevent the satellites from shining any brighter than 25th magnitude, about 100 million times fainter than can be seen with the unaided eye.

To locate these new moons, Holman and Kavelaars utilized an innovative technique. Using the 4.0-meter Blanco telescope at the Cerro Tololo Inter-American Observatory, Chile, and the 3.6-meter Canada-France-Hawaii Telescope, Hawaii, they took multiple exposures of the sky surrounding the planet Neptune. After digitally tracking the motion of the planet as it moved across the sky, they then added many frames together to boost the signal of any faint objects. Since they tracked the planet's motion, stars showed up in the final combined image as streaks of light, while the moons

accompanying the planet appeared as points of light.

Prior to this find, two irregular satellites and six regular satellites of Neptune were known. The two irregular satellites were also the largest: Triton, discovered in 1846 by William Lassell, and Nereid, discovered in 1949 by Gerard Kuiper. Triton is considered irregular because it orbits the planet in a direction opposite to the planet's rotation, indicating that Triton is likely a captured Kuiper Belt Object. (The Kuiper Belt is a disk-shaped collection of icy objects that circle the Sun beyond the orbit of Neptune.) Nereid is considered irregular because it has a highly elliptical orbit around Neptune. In fact, its orbit is the most elliptical of any satellite in the solar system. Many scientists believe that Nereid once was a regular satellite whose orbit was disrupted when Triton was gravitationally captured. The six regular satellites were discovered by the Voyager probe during its encounter with Neptune. The three new satellites were missed by Voyager II because of their faintness and great distance from Neptune. According to Holman, "The discovery of these moons has opened a window through which we can observe the conditions in the solar system at the time the planets were forming."

Tracking Faint Blips

The researchers are currently conducting follow-up observations to better define the orbits of the newfound moons using orbital predictions supplied by Brian Marsden (Director of the Minor Planet Center in Cambridge, Mass.) and Robert Jacobson (Jet Propulsion Laboratory).

To follow up the initial find, team members Brett Gladman (University of British Columbia, Canada); Jean-Marc Petit, Philippe Rousselot, and Olivier Mousis (Observatoire de Besancon, France); and Philip Nicholson and Valerio Carruba (Cornell University) conducted additional observations using the Hale 5-meter telescope on Mount Palomar and one of the four 8.2-meter telescopes of the European Southern Observatory's Very Large Telescope at Paranal Observatory, Chile. Grav made additional tracking observations using the 2.6-meter Nordic Optical Telescope on La Palma, Spain.

Holman says, "Tracking these moons is an enormous, international undertaking involving the efforts of many people. Without teamwork, such faint objects could be easily lost."

Based in La Serena, Chile, the Cerro Tololo Inter-American Observatory is part of the National Optical Astronomy Observatory, which is operated by the Association of Universities for Research in Astronomy, Inc., under a cooperative agreement with the National Science Foundation.

The Canada-France-Hawaii Telescope is operated by the CFHT Corporation under a joint agreement between the National Research Council of Canada, the Centre National de la Recherche Scientifique of France, and the University of Hawaii.

The European Southern Observatory is an intergovernmental, European organization for astronomical research. It has ten member countries. ESO operates astronomical observatories in Chile and has its headquarters in Garching, near Munich, Germany.

Headquartered in Cambridge, Massachusetts, the Harvard-Smithsonian Center for Astrophysics (CfA) is a joint collaboration between the Smithsonian Astrophysical Observatory and the Harvard College Observatory. CfA scientists organized into six research divisions study the origin, evolution, and ultimate fate of the universe.

Note to editors: An image of one of the three new Neptunian moons is online at http://cfa-www.harvard.edu/press/pr0303_image.html.

For more information and list of extra-solar planetary experts, contact:

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From: Dan Laszlo
2001 S Shields St Building H
Fort Collins CO 80526

TO:

International Space Station Passes for Fort Collins – Loveland February 2003

Date	Mag	Starts			Max. Altitude			Ends		
		Time	Alt.	Az.	Time	Alt.	Az.	Time	Alt.	Az.
04 Feb	2.0	18:29:13	10	NNW	18:30:17	11	N	18:31:21	10	NNE
05 Feb	2.0	19:07:23	10	NNW	19:08:06	12	N	19:08:06	12	N
06 Feb	1.9	18:09:28	10	NNW	18:10:38	12	N	18:11:48	10	NNE
07 Feb	1.4	18:47:05	10	NNW	18:49:06	17	NNE	18:49:06	17	NNE
08 Feb	1.7	17:49:10	10	NNW	17:50:43	13	N	17:52:16	10	NE
08 Feb	1.7	19:24:31	10	NW	19:25:44	20	NNW	19:25:44	20	NNW
09 Feb	0.9	18:26:32	10	NNW	18:29:04	22	NNE	18:30:06	19	NE
09 Feb	2.9	20:02:15	10	WNW	20:02:24	11	WNW	20:02:24	11	WNW
10 Feb	**-0.5**	**19:03:56**	**10**	**NW**	**19:06:50**	**61**	**N**	**19:06:50**	**61**	**N**
11 Feb	0.3	18:05:45	10	NW	18:08:39	32	NNE	18:11:21	11	E
11 Feb	1.8	19:41:53	10	WNW	19:43:39	23	WSW	19:43:39	23	WSW
12 Feb	**-0.4**	**18:43:13**	**10**	**WNW**	**18:46:20**	**67**	**SW**	**18:48:18**	**20**	**SE**
13 Feb	2.3	19:21:41	10	W	19:23:37	15	SW	19:25:27	10	SSW
14 Feb	1.1	18:22:24	10	WNW	18:25:17	34	SW	18:28:09	10	SSE
16 Feb	2.4	18:01:38	10	W	18:03:55	18	SW	18:06:11	10	S
25 Feb	2.5	05:57:21	10	S	05:59:18	16	SE	06:01:17	10	E
27 Feb	1.4	05:33:54	10	SSW	05:36:37	27	SE	05:39:20	10	ENE
28 Feb	2.5	04:36:26	11	SSE	04:37:29	12	SE	04:38:48	10	ESE
28 Feb	-0.6	06:09:59	10	WSW	06:13:05	67	NW	06:16:13	10	NE
01 Mar	0.1	05:12:14	25	SSW	05:13:43	50	SE	05:16:46	10	ENE
02 Mar	2.2	04:15:33	17	ESE	04:15:33	17	ESE	04:16:51	10	E