



# SJAA EPHEMERIS

## SJAA Activities Calendar

Jim Van Nuland

(late November)

- 30 Astronomy Class at Houge Park. "The Local Group – A 3D view of what is around the Milky Way", 7:30 p.m.
- 30 Houge Park star party. Sunset 4:51 p.m., 53% moon rise 2:01 a.m. Star party hours: 7:00 to 10 p.m.

December

- 1 Dark Sky weekend. Sunset 4:51 p.m., 43% moon rises 0:34 a.m.
- 8 Dark Sky weekend. Sunset 4:50 p.m., <1% moon Not Visible. Henry Coe Park's "Astronomy" lot has been reserved.
- 14 Houge Park star party. Sunset 4:51 p.m., 27% moon sets 9:45 p.m. Star party hours: 7:00 until 10:00 p.m.
- 22 General Meeting at Houge Park. 8 p.m.. Our own Dr. Lee Hoglan will speak on Night Myopia. The annual holiday part will follow. See last year's description at <http://ephemeris.sjaa.net/0612/d.html>
- 28 Houge Park star party. Sunset 4:58 p.m., 69% moon rise 10:21 p.m. Star party hours: 7:00 until 10:00 p.m.
- 29 Dark Sky weekend. Sunset 4:59 p.m., 61% moon rise 11:22 p.m.

January

- 5 Dark Sky weekend. Sunset 5:04 p.m., 4% moon rises 6:15 a.m. Henry Coe Park's "Astronomy" lot has been reserved.
- 11 Houge Park star party. Sunset 5:10 p.m., 14% moon sets 8:44 p.m. Star party hours: 7:00 until 10:00 p.m.
- 19 General Meeting at Houge Park. 8 p.m.. Dr. Jeff Moore of NASA will tell us of the Pluto Express Jupiter Encounter Update.
- 26 Dark Sky weekend. Sunset 5:21 p.m., 77% moon rise 10:06 p.m.

**24 hour news and information hotline:  
(408) 559-1221**

## December General Meeting

**Dr. Lee Hoglan**

**Dec. 22, 2007 - 8 p.m. - Houge Park**

David Smith

Did you know that the wide-open, dark-adapted eye is more myopic (nearsighted) than during the day? At our December 22 meeting, SJAA member Dr. Lee Hoglan will describe night myopia and other aberrations of the human eye, such as astigmatism and spherical aberration, along with the differences between photopic and scotopic vision. He will also cover tactics to deal with these issues while observing. Lee earned his Doctor of Optometry degree at the Southern College of Optometry, Memphis, TN, and practices optometry at his office in Saratoga. He has been an amateur astronomer since high school.

## **New Board Members Needed**

Rob Hawley

We have two openings on the board of directors; one now and one in February. The club will hold Elections for board members at the February meeting on Feb 16, 2008, provided candidates are available.

Board members need to support the purpose of the club and be willing to offer their advice. While many board members also volunteer to make the club activities happen, others only have the time to attend the monthly meetings. Either contribution is valuable.

While it is not a formal requirement, I strongly recommend that anyone thinking about joining the board attend at least one board meeting. That will give you a better idea of the dynamic of being a board member and what issues the board is focusing on.

In 2008 a major focus will be revitalizing the loaner program. The board has already voted to remove several scopes from the program. We will also likely be voting to purchase products where the program is lacking.

In addition, we have the routine business of making sure that the 270+ members of SJAA get their newsletters, that star parties happen, and determining what events SJAA is interested in supporting. Basically the nuts and bolts of making the club happen.

If you are interested please drop me an email at [president@sjaa.net](mailto:president@sjaa.net). Alternatively feel free to just attend the next board meeting or subscribe to the board mailing list.

# DEEP SKY OBSERVING

by Mark Wagner

December 2007 third quarter to new moon observing list. The list begins in the north and moves southward. Objects are within roughly a one hour section of right ascension that is at a comfortable elevation to the east at astronomical dark. This list is just a sampling of the full list which is at <http://www.resource-intl.com/Deep.Sky.Dec.07.html>.

Object	Const.	Type	Size	Mag	R.A.	Dec.
NGC 884	Per.	OC	29.0'	6.1	02 22 20	57 08 00
Can you split the Double Cluster into two halves naked eye?						
NGC 869	Per.	OC	29.0'	5.3	02 19 04	57 08 06
Can you split the Double Cluster into two halves naked eye?						
M34	Per.	OC	35.0'	5.2	02 42 08	42 45 00
NGC 1039. Nice binocular object.						
NGC 1023	Per.	GX	8.7'x2.3'	10.4	02 40 24	39 03 46
18" f/4.5. Very bright core with long tenuous arms to the E&W.						
NGC 772	Ari.	GX	7.2'x4.2'	11.2	01 59 19	19 00 30
18" f/4.3. bright, very large, elongated. Impression of spiral arm.						
NGC 1055	Psc.	GX	7.6'x2.6'	11.4B	02 41 44	00 26 31
18" f/4.3. bright, large elongated galaxy, nearly edge on.						
M77	Cet.	GX	7.1'x6.0'	9.6B	02 42 40	-00 00 48
NGC 1068. Arp 37. 150mm f/12. tight spiral with many arms.						
NGC 779	Psc.	GX	4.0'x1.1'	12	01 59 42	-05 57 52
17.5" f/4.5. Bright, very elongated, brighter core, stellar nucleus.						
NGC 720	Psc.	GX	4.6'x2.3'	11.2	01 53 00	-13 44 21
17.5" f/4.5. Bright, 2.0'x1'. Well defined core, faint outer halo.						
NGC 1022	Psc.	GX	2.4'x1.9'	12.1B	02 38 32	-06 40 42
8" f/6. faint, small, diffuse, broad concentration, slightly elongated.						
N0991	Psc.	GX	2.7'x2.4'	12.4P	02 35 32	-07 09 15
17.5" f/4.5. Large, diffuse, weak concentration.						
NGC 1084	Eri.	GX	3.2'x1.7'	11.3B	02 45 59	-07 34 42
17.5" f/4.5. Lots of detail. Bright, mottled, dark lanes, irregular.						
NGC 1052	Psc.	GX	3.0'x2.4'	10.4	02 41 04	-08 15 22
13.1" f/4.5. Very bright, small, round, intense core. Large group.						
N1045	Psc.	GX	2.3'x1.2'	12.9	02 40 29	-11 16 38
17.5" f/4.5. Bright, small, prominent core, stellar nucleus.						
NGC 908	Psc.	GX	6.0'x2.6'	10.8B	02 23 05	-21 13 59
17.5" f/4.5. Fairly bright, large, irregular, possible nucleus.						
Arp 77	For.	GX	12.7'x9.4'	10.2	02 46 18	-30 16 21
17.5" f/4.5 NGC 1097 very bright large & elongated, bright core.						

Note: Source catalogs are Messier, Arp, Abell Planetary, Abell Galaxy Cluster (AGC), Hickson Compact Galaxy (HCG), Sharpless III Regions, Barnard Dark Nebulae, Herschel 400-I, Herschel 400-II. Herschel 400-I are identified as NGCXXXX, Herschel 400-II as NXXXX.

## Mars Under the Tree

Akkana Peck

Mars is at opposition on Christmas eve!

This isn't a close opposition. Our small neighbor won't get bigger than 15.9" (that's arc-seconds, not inches) – between a third and half the apparent size of Jupiter. But there's some good news, too: it'll be REALLY HIGH, just 10 degrees short of the zenith. If we get some steady air, you can slip in your shortest eyepiece and really crank up the magnification.

Closest approach is actually the week before opposition, on the 19th. But really, Mars should be good all month (plus January and most of February), so keep your scope ready to sneak a peek whenever the skies are clear.

This opposition is somewhat unusual in that we'll be seeing Mars nearly equator-on. So we should be able to see both hemispheres fairly equally, and may even be able to see both polar caps at once. Mars will hit its equinox (autumnal for the southern hemisphere, vernal for the northern) on December 9, so the north polar cap will be very prominent while the southern cap will be quite small. Throughout December we should be able to see the hazy "north polar hood" gradually break up to expose the brighter polar cap beneath.

If you read about observing Mars, you'll see a lot of advice about using filters of different colors to bring out specific details. Should you worry about that? The answer is no. If you have picked up a set of colored filters at the SJAA swap meet last month, then you're all set – use them and see what you can see! But if you don't have any, don't feel like you have to rush out and buy some. I find that filters make only a subtle difference. Sometimes a colored

filter will help me notice something I might not have noticed otherwise – but then after I remove the filter, I've always been able to see all the same features. What about telescopes? Do you really need a 7" Astro-Physics refractor?

Well, I won't deny that it helps. If you happen to have one sitting around the house, by all means use it! But I've seen detail on Mars in an opposition less favorable than this one through my 4-1/4" f/4 backpacking reflector (think glorified Astroscan). Like most shallow skyobserving, the only rule is: Use What Ya Got.

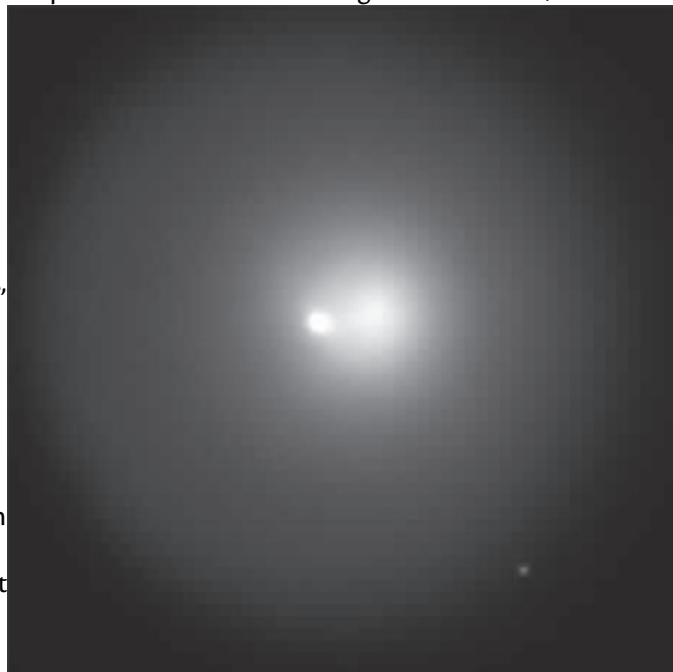
There's a naked-eye Mars show, too: on the night of the 23rd, Mars and the full moon have a very close encounter (a quarter of a degree). If you're visiting relatives anywhere north of Portland, you can see an occultation.

I hope you all got a chance to see Comet 17/P Holmes (2007) last month. What a nice surprise it was to see a naked-eye comet suddenly grace our northern sky! Comets are frustrating for a columnist,

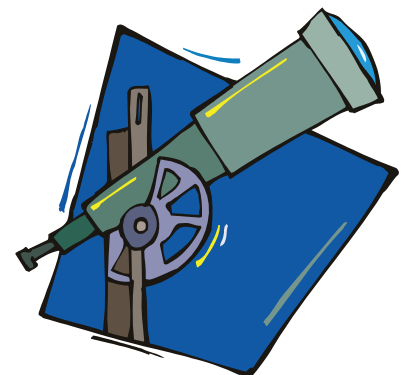
because the best ones don't give much warning – they suddenly appear, or flare up without notice. Email lists are the best bet for keeping track of events like that.

A few comets are more predictable, though. This month, periodic comet 8P/Tuttle is expected to brighten to naked eye levels (barely) by the close of 2007 when it comes within .25 AU of the Earth (a quarter of the distance from us to the Sun). It'll be passing through Andromeda, crossing about seven degrees east of M31 on the 27th and 28th, then along the outskirts of M33 in the early evening of December 30th. (It actually goes right through M33, but that happens during our daytime.) M33 and 8P/Tuttle should actually be fairly close in brightness by then, so it might be an interesting sight. Google for Comet 8P/Tuttle for a more detailed finder chart.

It's a good thing we have Mars and comets, because there's not much else going on in the shallow sky this month. Jupiter disappears into the sunset by the middle of December. Uranus and Neptune hang around longer in the evening, but they're not especially high or well placed. Saturn rises late in the evening and transits around 4 am. Venus continues its domination of the morning sky.



Comet Holmes as imaged on October 28, 2007 shortly after midnight. Get the latest info at <http://www.sjaa.net/Comet17PHolmes.html>. Photo courtesy of Paul Kohlmeier.



## Why is the Sky Dark ... and Quiet?

### Thoughts on the Fermi Paradox

Paul Kohlmiller

In the middle of lunch in the summer of 1950, Enrico Fermi, a Nobel-winning physicist, blurted out the question "Where is everybody?" Fermi backed up his question with some quick calculations based on the size and age of the galaxy, the likelihood of Earth-like planets and some other factors. It seemed that Earth should have been visited many times by extraterrestrials and yet we apparently have not. So, where is everybody?

Events have occurred to make the Fermi Paradox more relevant over time. In Science:

1. 1961 – Frank Drake, the father of SETI, presented the Drake Equation which is used to estimate the number of technologically advanced civilizations in the galaxy.
2. 1975 – Michael Hart writes a paper that shows that the Fermi Paradox has scientific merit.
3. 1995 – Exoplanets are found, the Drake equation gets some information for one of its factors.

In TV and movies:

1. Star Trek – 1966-1968. Though far too optimistic regarding star travel, many elements have already come true (e.g. cell phones) and a large number of future astronomers are inspired.
2. ET – 1982. The movie ET adds that 2-letter "word" to the language.
3. Contact – 1997. The movie based on Carl Sagan's book celebrates the spirit of SETI.

And in books:

1. Rare Earth - Ward and Brownlee (2000), this book pointed out the various things that make the Earth unique: large moon, well-placed Jupiter, plate tectonics, asteroids to kill dinosaurs, and centrally placed in a habitable zone. Just like the realtors tell you, "location, location, location".
2. Life Everywhere: The Maverick Science of Astrobiology - David Darling (2002),

an answer to Ward and Brownlee that covered the possibilities of life. It also directly challenged Ward and Brownlee's motivation by noting the influence of a creationist on their writing.

3. Where is Everybody? - Stephen Webb (2002) attempts to exhaustively look at each possible answer to the paradox, 50 in all.

Another well-known astronomical paradox is Olbers' Paradox (see *Ephemeris*, July 2006). Olbers asked, "where are they" but the "they" he referred to were simply stars. If the universe is infinite then, no matter which direction you look, you should see a star. So instead of "where are they", Olbers' question is usually stated "Why is the night sky dark?"

Consider the possibility that the Fermi Paradox can be answered the same way as Olbers' Paradox. There were assumptions implicit in the question "Why is the night sky dark?" One of these was that there are no major systematic motions in the Universe. Early in the 20th century, it was widely held that the universe was in a steady state. After Hubble demonstrated the universe is expanding, the steady state proponents saw this as a possible answer to Olbers' Paradox: if there is a major systematic motion in the Universe, namely Hubble's expansion, then some of Olbers' assumptions are not correct. According to P.S. Wesson, this made some sense before the big-bang theory but not so after it. Wesson says that the expansion answer was "uncritically repeated in research work and ... textbooks" because there was "no account of the relative importance of the expansion and finite-age factors". So Wesson used a computer model to compare two possible answers to Olbers' Paradox: expansion versus the finite age of the universe. Wesson ran the model with and without an expanding universe. The result in both

cases was exactly what we see: a dark sky. But setting the rate of expansion to zero only made a slight difference.

The parallels to the Fermi Paradox is that some of the original assumptions are not correct but strong adherence to certain models may cause us to look for answers that won't stand up to scientific scrutiny. Indeed, Olbers' Paradox and the Fermi Paradox may have the same answer: particular phenomena, be it stellar light or evidence of extraterrestrial intelligence, takes a long time to arrive.

The modern answer to Olbers' is that the universe is not infinite, at least, we can't see stars that are infinitely far away. The universe appears to be about 14 billion years old so any stars that are more than 14 billion years away cannot be seen because the light from them hasn't reached us yet.

There are a few assumptions in the Fermi Paradox that seem unsupported. Consider just this one: A colonizing civilization will spread geometrically; moving from one location to two others, then each of those will move to two others, and so on and it will simply continue to do so. Jared Diamond's book "Collapse" shows how the Norse moved to Iceland, Greenland and Labrador and then retrenched. China destroyed its naval fleet rather than risk contamination from other cultures. American "Manifest Destiny" was stopped by the inhabitants north and south and by the Pacific Ocean in the west. So the answer to Fermi is the same as to Olbers, they/it aren't here yet.

Beings as temporally limited as we are, would prefer an answer that didn't require so much patience. But hope won't trump science in the long run and control of the fourth dimension seems unlikely. Otherwise, we could ask "Where is everybody, the people from the future?"

Not many endeavors require that you plan the mode of transportation before you even know what it is you are transporting. But weighing the physics and economics of getting any sort of cargo to space is a major part of designing a space mission.

It's one of the first issues that NASA's New Millennium Program (NMP) considers when planning a new mission. NMP has the forward-looking job to identify promising new technologies for space exploration. It then helps to mature the technology so it will be available to space missions of the future. If the technology cannot be tested adequately on Earth, the last part of this process is to actually send the technology into space. With carefully documented test results, future mission planners can confidently incorporate the new technology into their designs.

But where to begin? On call from the start, Linda Herrell is the New Millennium Program Architect. Given

a list of proposed technologies, she has the job of figuring out the feasibility of wrapping a mission around them.

"We might be considering six or more technologies, anything from solar panels to imagers to masts for solar sails to more intelligent software. Of those, we may choose four. My job is to answer the question—can the selected technology be transported to and operated in space within the constraints of a low-cost technology validation project?"

Along with the list of possible mission payloads (the technologies), Linda also has a list of spacecraft to put them on, as well as a list of launch vehicle parameters. All she has to do is try them out in every possible combination (of which there are thousands) and see what might work.

"Fortunately, we have a software tool to help with this analysis," says Linda. When it comes down to it, her job is

primarily to figure out how to get the technologies into space.

"Sometimes, it's like figuring out how to get across town when you don't have your own car. You have to get creative."

She keeps a database of all possible options, including riding piggyback on another spacecraft, hitching a ride on a launch vehicle as a secondary payload, or sharing a launch vehicle with other NASA, Department of Defense, or even commercial payloads.

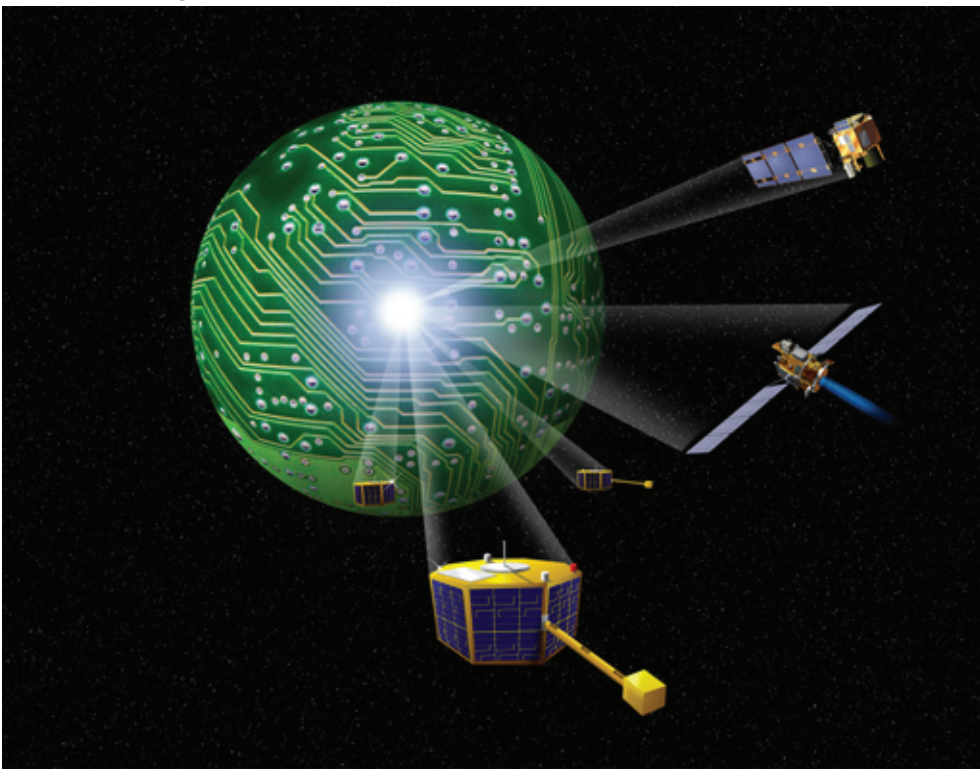
Her assessment is but one of a gazillion factors to be considered in planning a mission, but it is indeed one of the very first "details" that forms the foundation for the rest of the mission.

Find out some of the technologies that NMP has already validated or is considering at <http://nmp.nasa.gov/TECHNOLOGY/innovative-tech.html>. Kids will enjoy watching Linda's cartoon alter-ego talk about her job at <http://spaceplace.nasa.gov/en/kids/live>.

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

### "Solar Indigestion"

We usually take our star for granted. We forget that it's not just a big, bright, warm light bulb crossing the sky each day for our comfort and convenience. On the contrary, the Sun has a very active (if not meaningful) life of its own. And it's not always in a good mood. When the Sun is having a tantrum, or, even worse, indigestion, we are included in its "suffering." Space weather includes the effects of solar activity on Earth's environment--and us. Find out more about what happens to Earth during bouts of "solar indigestion" at <http://spaceplace.nasa.gov>.



NASA's New Millennium Program selects breakthrough technologies that will be of the greatest use to future space and Earth science missions and that are perceived to be risky to the first user.

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## The Last 31 Days In Astronomy

The news seen between October 11 and November 11, 2007.

OCT-11-2007 **GMT to be Built in Chile** The Giant Magellan Telescope (GMT) site has been announced. The telescope with an effective aperture of 80 feet will be built at Los Campanas in Chile. The resulting resolution is 10 times better than Hubble. It is expected to be completed in 2016. The mirror surface will be accurate to 1 millionth of an inch. <http://www.gmto.org/newsitems/gmtlcositeselectd>

OCT-25-2007 **Comet Holmes** One of the biggest astronomy news items of the year is how Comet Holmes has blossomed into a naked eye object long after perihelion. <http://www.astronomynow.com/news/071025holmes/>

NOV-01-2007 **Possible Water at Mars Equator** The Mars Express orbiter, launched by the ESA, has used radar to study an area called the Medusae Fossae Formation. The results indicate that there is some loosely packed material that is at least 2.5 kilometers thick. It might be volcanic dust or just more of the ordinary Martian dust that has blown into this area. However, such dust in an anhydrous environment should be packed tightly by now. The remaining possibility would be water ice which could have been formed when the Martian obliquity (tilt) was much different and the current equator was near the pole. But ice should have evaporated at least down to several meters. The radar equipment on the Mars Express was built by a collaboration between the University of Rome and JPL. <http://www.jpl.nasa.gov/news/news.cfm?release=2007-126>

NOV-06-2007 **Fifth Planet found at 55 Cancri** A fifth planet has been discovered orbiting 55 Cancri. Debra Fischer and Geoff Marcy and a team of collaborators took 320 velocity measurements at Lick and at Keck. The planet is too large to be Earth-like but if it has a large moon that moon might contain large bodies of water. Interesting. <http://www.jpl.nasa.gov/news/news.cfm?release=2007-128>

NOV-07-2007 **STS-120 Landing** The space shuttle Discovery completed a most unusual mission with a perfect landing at Cape Canaveral. The mission dropped of the Harmony module but became more famous by the unplanned fixing of a solar panel that tore while it was being unfurled. The next mission will use Atlantis in its last flight before the Hubble fixing mission in mid-2008. The following link leads to photos, videos, and other interactive features including the first high definition video of a shuttle launch. [http://www.nasa.gov/mission\\_pages/shuttle/main/Shuttle\\_Multimedia\\_Collection\\_archive\\_1.html](http://www.nasa.gov/mission_pages/shuttle/main/Shuttle_Multimedia_Collection_archive_1.html)

NOV-11-2007 **Artificial Asteroid** An asteroid headed for a near miss with Earth has turned out to be artificial. In fact asteroid 2007 VN84 is the European spacecraft Rosetta which is actually right on schedule for a flyby of Earth on its way to orbit the comet Churyumov-Gerasimenko. It's not entirely clear how a billion dollar mission with 3 planned flybys of Earth could not be detected before getting an asteroid designation. But it has happened before. Asteroid J002E3 turned out to be part of the Saturn rocket that sent Apollo 12 to the moon. <http://www.space.com/business/technology/071112-technov-asteroid-mistake.html> <http://spaceguard.esa.int/tumblingstone/issues/num17/eng/apollo.htm>

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*Starry, Starry Night*

### Mirfak

Paul Kohlmiller

The star Mirfak (rhymes with Beer-back) has received a lot of attention lately because it is the closest bright star to the comet Holmes in its recent brightening. It is the brightest star in Perseus. The name of the star comes from an Arabic phrase meaning "the elbow of the Pleiades". It is also well known for its proximity to Algol, the famous eclipsing, variable double star. Mirfak's magnitude is 1.82 and it is 590 light years away. It's an F class star that has a luminosity equal to 5000 times that of the sun and its radius is 62 times greater. Its mass is 7 to 8 times solar - the uncertainty a result of not knowing if it has starting fusing helium yet or not. It is part of a cluster. Looking at Mirfak through binoculars you can see many stars around it. It appears that Mirfak is really part of that cluster, the cluster as a whole determined to be 575 light years away.

To find Mirfak, start at Casseiopeia and find the line between Gamma Cas (the middle star) and Ruchbah (the fourth star in Casseiopeia along the less acute angle in that constellation's "W"). Continue along that line through the Perseus double cluster (NGC 869/884). Besides Comet Holmes, Mirfak was also close to Comet Machholz in 2005.

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### Telescope Loaner Program

(see elsewhere this page)

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#### Publication Statement

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#### Submit

Submit articles for publication in the SJAA *Ephemeris*. Send articles to the editors via e-mail to [ephemeris@sjaa.net](mailto:ephemeris@sjaa.net). **Deadline, 10th of previous month.**

## Loaner Program Up and Running

Rob Hawley

The loaner program is now fully running! All of the available scopes are, well, available. The list below is a summary of what was available as of 11/11/07. Please note that Rich and I are examining the scopes as they are being exchanged. We have found a number that need repair and several that just did not belong in the program. We ask your understanding, but this prevents you from having to store a scope you will not be willing to use.

The board will be investing in the program during 2008. A member donated a new Orion SkyQuest XT6 IntelliScope with Object Locator to the club in November. Noted telescope designer Albert High is currently rebuilding another scope. The board intends to make further purchases and repairs to insure the inventory is suitable.

Those that have an outstanding scope loan can greatly help the club by keeping their contact information current. Most of the work in the program so far has been tracking down people to exchange the scope they were storing.

## Available Scopes

These scopes are available for loan as of Nov. 10, 2007.

Size in inches	Scope Number	Scope Description
	10	Star Spectroscope
3.5	47	Meade ETX 90
4	44	4.5" f/8 Orion Skyview Newt
4	43	4.5" f/8 Orion XT Dob
6	32	5.5" f/7.6 Signature Dob
6	11	6" f/8 Orion XT Dob
6	13	6" f/8 Orion XT Dob
6	23	6" f/8 Edmund Newt on EQ Mount
8	34	8" f/10 Dynamax S/C
8	12	8" f/6 Orion XT Dob
8	35	8" f/6 Meade Newt on EQ Mount
8	14	8" f/8.5 Homemade Dob
10	33	10" f/4.5 Orion DSE Dob
10	45	10" f/5 Dob, Earletron
11	9	C-11 f/10 Compustar
12	7	12.5" f/7 Homemade Dob
14	8	14" f/5 Homemade Truss Dob
18	41	18" f/4.5 Sky Designs Dob

For the latest information and for a list of scopes already loaned see <http://www.sjaa.net/loaners/sjaaloan.html>

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## San Jose Astronomical Association Membership Form

P.O. Box 28243 San Jose, CA 95159-8243

**New**    **Renewal** (Name only if no corrections)

**I'll get the Ephemeris newsletter online**

<http://ephemeris.sjaa.net> Questions?

Send e-mail to [membership@sjaa.net](mailto:membership@sjaa.net)

### Membership Type:

- Regular — \$20  
 Regular with Sky & Telescope — \$53  
 Junior (under 18) — \$10  
 Junior with Sky & Telescope — \$43

Bring this form to any SJAA Meeting  
or send to the club address (above).

Please make checks payable to "SJAA".

Subscribing to Sky & Telescope magazine through the SJAA  
saves you \$10 off the regular rate. (S&T will not accept multi-year  
subscriptions through the club program. Allow 2 months lead time.)

You can join or renew online:

<http://www.sjaa.net/SJAAmembership.html>

**Name:** \_\_\_\_\_

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**City/ST/Zip:** \_\_\_\_\_

**Phone:** \_\_\_\_\_

**E-mail address:** \_\_\_\_\_