HAMILTON AMATEUR ASTRONOMERS

Event Horizon

Volume 1 Issue 5 March 1994

Editorial

As the sun moves in is steady pace towards the celestial equator, we gradually approach warmer temperatures and spring. The place at which the sun's path crosses the celestial equator is known as the first point of Aries. Oddly enough, this occurs in the constellation of Pisces.

With the coming of spring come shorter nights. Now I know that I am a "naturalist of the night," but I am more than glad to give up some dark hours in return for some warmer temperatures. Although the nights have been long this winter, they have been all but useless. Those nights that were warm enough that one would not risk losing limbs to frost bite, were cloudy. Call me a hypocrite, but enough is enough, turn off the snow and crank up the temperature.

As always if you have any articles, ideas, scribbles or pictures, please get them to me however you can and in whatever format you can. Also, if you are artistically inclined (or declined), the pages of this newsletter could certainly benefit from your efforts.

This past month has seen a lot of activity. The articles that follow better describe them than I could. So with that, lets get to the articles.

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HAMILTON AMATEUR ASTRONOMERS

Chair's Report

February seems to have flown past and finally it looks like we are in for some warmer weather. The better weather, of course, means that people will be more enthusiastic about nighttime outdoor activities. At our last Council meeting, we discussed a number of options for the coming months. One great excuse for a trip, is to visit Pelee Island, the southernmost place in Canada, where the magnificent globular Omega Centauri barely comes above the horizon. Word on the street has it that some Windsor amateurs tried this a few years back and were successful. We will probably try for something in April or May, when it transits at a decent evening hour. Another possibility for later in the summer is an observing weekend at Silent Lake, north of Peterborough More details later.

One of our members, Terry Dickinson, has had an asteroid named after him! Terry, as you know, is the leading popularizer of astronomy in Canada and has written many books, including the incredibly useful Nightwatch. According to a Globe and Mail report, the asteroid is about 4 km across and is in the main asteroid belt at an average distance of 331 million km.

Patricia Marsh has agreed to start the official HAA scrapbook, for newspaper clippings and similar memorabilia. Please feel free to contribute!

You will be pleased to know that Ann Tekatch has plowed through the appropriate paperwork, and that we have now submitted our request for non-profit organization status. When the wheels of government eventually grind through our application, I will let you know.

March is the traditional month for Messier object hunting. With a little telescope and a lot of coffee, it is possible to see almost all the (real) objects in one night.

Of course, the big news in the immediate future is the annular solar eclipse on May 10, which is only two months away. For once, we do not have to travel to see an eclipse! We will have some welder's glass available to members at our April meeting, since it is necessary to have adequate eye protection at all times during an annular eclipse.

So grab your hip-waders, springtime is a great time to enjoy the sky.

Doug Welch

Inside This Issue

Planetary Nebulae ~ Part 1

I would like to tell you something about one of my favorite objects for viewing in the night sky - planetary nebulae.

Nebula (plural nebulae) is a Latin word meaning mist. It has been in use since before the invention of the telescope to describe small hazy patches of light found in the night sky. The term Planetary Nebula refers to an object that has an appearance similar to a particular planet (we'll get to that shortly).

The 27th object in Charles Messier's famous list is the first recorded observation of a Planetary Nebula. It is usually referred to as M27 or the Dumbbell Nebula. The date of this discovery was July 12, 1764. William Herschel, the discoverer of the planet Uranus, found 2300 nebulae of various types over a period of just 7 years in the late 1700's. He divided these objects into eight categories:

I Bright nebulae
II Faint nebulae
Ill Very faint nebulae
IV Planetary nebulae
V Very large nebulae
VI Very compressed, rich clusters of stars
VII Compressed clusters of small and large stars
VIII Coarsely scattered clusters of stars

Herschel came up with the name planetary nebulae for the fourth category since these objects reminded him of the appearance of the planet Uranus. They tend to be in the shape of disks and sometimes appear to have a greenish colour. Up until 1990 the total number of known planetary nebulae was just over 1300. To put this number in perspective consider that there are about two hundred billion stars in our own galaxy. This shows that these objects are actually quite rare. It turns out that one of the reasons for this is the short lifetime of this phenomenon.

So, what are these objects? There is uncertainty about some aspects of the actual process that forms these nebulae. I will attempt to give you a simplified version.

Stars that are approximately the same mass as our sun spend most of their lives converting hydrogen into helium through nuclear fusion. During this period there is a balancing act between gravity trying to squeeze the star into a smaller volume and pressure (thermal motion plus radiation pressure) pushing outward. This process continues for billions of years with helium gradually forming a larger and larger core at the centre of the star. At some point gravity causes the core to contract since it is no longer undergoing nuclear fusion. This contraction actually increases the temperature of the core. Normal gas pressure is no longer enough to prevent this contraction from continuing being halted only by electron pressure. At this point the material in the core is said to be "degenerate". (A whole article could be written about this state of matter. Perhaps another time.) The new thermal and gravitational balance of the star causes the outer layers of the star to expand. The larger diffuse outer envelope becomes cooler and redder. The star is then said to be in the red giant stage.

Helium continues to accumulate in the core and eventually the temperature and pressure become high enough for helium to begin converting to carbon and oxygen. This process proceeds at a very rapid rate raising the temperature even further. However, degenerate material does not expand like ordinary matter as it heats up. Eventually though, the temperature gets high enough that the material is no longer degenerate. This results in an explosive ignition of the core called the "helium flash". As with the hydrogen, the helium gets used up resulting in a core of oxygen and carbon which no longer undergoes fusion. The core contracts as before but stars about the same mass as our sun are unable to fuse carbon and oxygen into heavier elements.

Layers of hydrogen and helium

M27

which surround the core continue to undergo fusion. This part of the process is very unstable with alternating periods of compression causing layers of helium to fuse and expansion due to increased energy production followed by a cessation of helium fusion due to lowered pressure. This causes the outer envelope of the star to repeatedly expand and contract. During the expansion phases large amounts of the star's atmosphere are blown any. In the final stages of this process the core of the star is all that remains surrounded by an expanding shell of gas and dust.

The bare core has a surface temperature between 30,000 and 400,000 degrees Kelvin. Objects that are this hot radiate a lot of ultraviolet light. This radiation excites the surrounding gas shell causing it to give off visible light. It is this stage of the star's life, which we observe as a planetary nebula. The shell will continue to expand and eventually become too faint to be visible in about 30,000 years. The remaining core (a white dwarf) will be about the same size as the earth and have roughly one half the mass of our sun.

In Part 2, I will tell you how to observe these objects.

Stewart Attlesey

Greek in the Round

Are you anxiously waiting for the second half of Perseus' story? Good! Last month we saw Perseus slay the Gorgon Medusa. This month he encounters the beautiful maiden Andromeda. Let's begin with her story.

According to the Greeks, Andromeda was the lovely daughter of Cassiopeia and Cepheus. Proud of her daughter's beauty and her own, Cassiopeia one day foolishly boasted that both were the fairest that ever lived. This soon reached the unbelieving ears of Hera, the jealous wife of Zeus, and the Nereids, who were nymph-maiden favourites of Poseidon. They demanded that Poseidon immediately avenge Cassiopeia's majesty.

Poseidon therefore sent a sea monster, Cetus to attack Cepheus' kingdom. The monster is now usually depicted as a whale, but in the original story Cetus was a cross between a fire-breathing dragon and one of those fearsome, ship-devouring "sea serpents" bred in the darker corners of sailor's imaginations. With his kingdom in terror, Cepheus consulted an oracle for advice. The appalling reply: To save the realm, Andromeda must be delivered up to Cetus. Heavy-hearted and bitter over his wife's vanity, Cepheus was forced by his people to comply. The place chosen for the sacrifice was a rugged part of the coast. Andromeda was chained hand and foot to a large rock to await her grisly doom.

Soon the monster swam by and noticed her. Hissing with delight he clambered out of the water and slithered across the boulders toward the screaming girl.

Suddenly Cetus felt a sharp, slicing pain. He turned and saw a man behind him armed with a great bronze sword. Again and again the man struck, but as pain lanced through the creature and his blood gushed forth, Cetus felt his strength increasing. The man was none other than Perseus. Fired with a killing rage, he produced the Gorgon head be had just killed and whose face was so hideous that all who looked directly upon it were turned to stone with fear. Cetus was turned to stone. Next Perseus called down his flying horse Pegasus (who's devotion he'd won at Medusa's death) and, delighted by the girl's beauty, carried Andromeda home to marry her.

Unfortunately, the gods felt that Cassiopeia had gotten off lightly. So they tied her to her throne and condemned her to circle the Pole Star endlessly, alternating sitting right side up and dangling upside down

When Perseus and Andromeda arrived back to the land where his mother awaited his return, he found his mother and stepfather hiding from the King still seeking to force marriage believing Perseus was gone forever. Perseus traveled to the kingdom, greatly surprised the King and said "Here is your gift!" and he held up the Medusa's head for all to view. A second later the room was a gallery of statues of evil men frozen in horrible death.

And the evil grandfather of Perseus? Acrisius had long since fled his kingdom, but one day Perseus, while attending funeral games which is comprised of an athletic competition, hurled a javelin that went astray and killed a spectator, Acrisius. And so the death foretold to him came true, despite all of his efforts to evade it.

The rest of the life of Perseus and Andromeda was happy. They ruled their land wisely and had many children. One of their great grandsons was Hercules But most important of all, the tale of their lives endures as the most star-honoured of all time.

"Wish Upon a Star"
Ev Butterworth

Free Filters for Members!

Here in Hamilton we will be fortunate enough to view a complete "annular" solar eclipse on May 10, 1994. In honour of this rare event, the Hamilton Amateur Astronomers membership will be receiving something special.

The April 8, 1994 general membership meeting will be dedicated to the solar eclipse in preparation for safe observation plus much more. We will be handing out a free filter to every member in attendance. Family memberships will receive one free per family; single memberships also will receive one free each. We will have extra filters for sale at the April meeting only for a nominal cost. Unfortunately, we will not be able to distribute

these filters at any other time. Recipients must be present at the meeting for safe solar viewing instructions.

We look forward to seeing everyone at the meeting in April.

Blackened Tube Telescope

Did you know that a simple tube with the inside surface blackened, will boost your vision to almost the same as 50 mm binoculars? Of course there is no magnification, but it is low cost, lightweight, easy to use, and does not require focusing. Also, the apochromatic, distortion free, diffraction limited optics are the best on Earth. It works because, the tube blocks the light from the other things you are not looking at. The light from all the other things, is often called stray light. If this stray light enters your eye, it makes it harder to make out dim objects. This happens because the stray light makes the area around the object brighter. We use this difference in brightness between the object and the area around it to see that something is there. So, the greater the difference in brightness, called contrast, the easier it is to see a dim object or star. For you technical folk, the blackened tube telescope will increase your naked eye limit about two magnitudes. So what are you waiting for, make one now! Hurry!

Bill Tekatch

Messier Marathon '94

Once a year, for a few weeks around the spring equinox, it is possible to see all 110 of Charles Messier's famous deep sky objects, in one night! To see all 110 M-objects (as catalogued in the Observer's Handbook) is a challenge that all observers should try at least once. In order to be successful, you must be prepared. The following is intended to give anyone attempting the challenge some hints and strategies.

Pick a night around the new moon. A thin crescent is not much of a problem so long as it sets before evening twilight ends, or rises after morning twilight begins. Pick a dark site with no obstructions, particularly in the southeast and northwest. These are critical areas where you will be locating some objects in the twilight hours. I would recommend at least a 6" telescope to see them all, however it is possible to see up to 85 objects with 7x35 binoculars. Bring the usual eyepieces, red light, pencil, paper and an atlas such as Sky Atlas 2000.0 or better yet – Astro-Cards (they are small and compact). Remember that March nights are still cold, so dress warmly and bring a thermos of hot chocolate and munchies to warm yourself up. A chair and small TV table (or something to place your maps and notes on) are also essential for a successful night. A clipboard will help you keep your notes in order. To protect your notes from the dew (or more likely FROST!!) you can place an overhead transparency on top.

Now that we have some of the logistics taken care of, how do we ensure that we get all of them? The best advice is - PLAN AHEAD! Know what you are looking for and when. Bring an ordered check-list of the 110 M-objects, like the one included at the back of the newsletter. Set-up at the site before dark so you can check your telescope's collimation and finder scope alignment. Hit some of the brighter objects before twilight ends, such as M42/43 and M45. This will give you more time for those objects like M31, which are low in the twilight. Don't spend more than 5 minutes locating each object. If you can't find one go on to the next (Sounds like the advice you get when writing a multiple choice test). Use binoculars for the brighter objects, this way you can quickly scan the skies instead of struggling to find it in the telescope's narrower field of view. You may also see several objects at once, such as in Sagittarius, where there are many clusters in a small area of sky. Work your way in an easterly direction. Remember that more southerly objects do not hang around for long.

Some of the toughest areas are the Realm of Galaxies in Virgo, and the Sagittarius star field. It would be advisable to try and go through the Virgo cluster a few days earlier to familiarize yourself with it. The problem with Virgo is that there are so many galaxies; it is hard to tell which ones are which. A general rule is that the brighter ones are more likely to be M-objects not NGC's. The only sure way to tell is to check them out with star fields and neighbouring galaxies. Here an atlas like Uranometria 2000.0 would be more helpful, since it lists stars down to 9th magnitude. Fortunately, when you are at this stage in the marathon, the time constraints are more relaxed. In the Sagittarius region, there are again a large number of objects to find. Here the problem is not so much identification, but time. By this stage, twilight is only a short time away. Speaking of twilight, the last Messier object to rise is M30 in Capricornus. For observers here in Canada, this rises after twilight. Sounds like a good excuse to move to Florida!

Good Luck -and may you all win!

Charles Baetsen
524-0148

(A checklist has been included at the back of this issue to aid you in your hunt.)

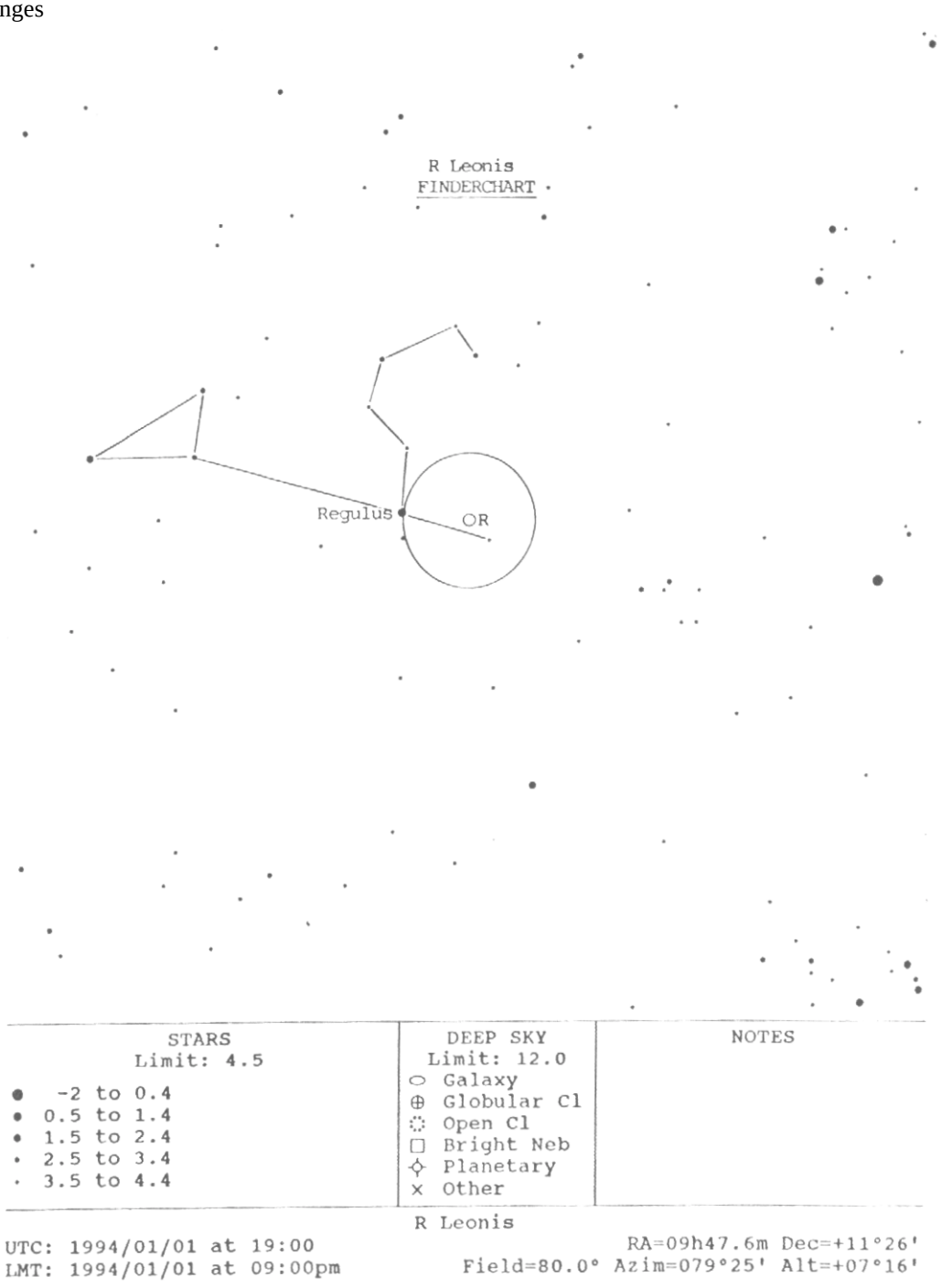
Variable Star of the Month: R Leonis

In the November issue of Event Horizon, I introduced you to a star called Algol that changes brightness every 3 days. Algol is not the only star that changes brightness. There are many stars known to vary. These “variable stars” change their light output (or apparent light output as is the case with Algol) for different reasons.

Algol belongs to the class of variables known as “eclipsing binaries”. This month, well look at a star belonging to the “long period” class of variables. Long period variables are also called “Mira” variables after the famous star in the constellation Cetus, that first brought these stars to our attention. Before we continue, though, let me explain how variable stars are named.

The most difficult thing to understand about variable stars is how they are named! By the time astronomers discovered variables, they had already used up the Greek alphabet, the Roman alphabet and started using numbers to name the stars visible to them. It turned out, however, that the last few capital letters of the alphabet remained available, starting with 'R'.
Thinking that variable stars were a rarity and that there would never be more than 9 in a constellation, they adopted this system of naming them. The first variable discovered in a constellation would be designated 'R' and followed by the possessive form of the constellation's name. This system quickly proved inadequate and we soon had variables called 'RR', ‘RS’... up to 'ZZ'. After 'ZZ', astronomers began with 'AA' and continued until they had used up all the double capital letters. In all, a total of 334 combinations were available for each constellation. You'd think that would be good enough! But, when the 335th variable was found in a constellation, astronomers, being the imaginative souls they are, named it V335.

Now that I’ve bored you to tears with variable star administration, let's get back to our "star of the month": R Leonis. By now, you'll know that the 'R' means it was the first variable star discovered in the constellation, Leo ("Leonis" is the



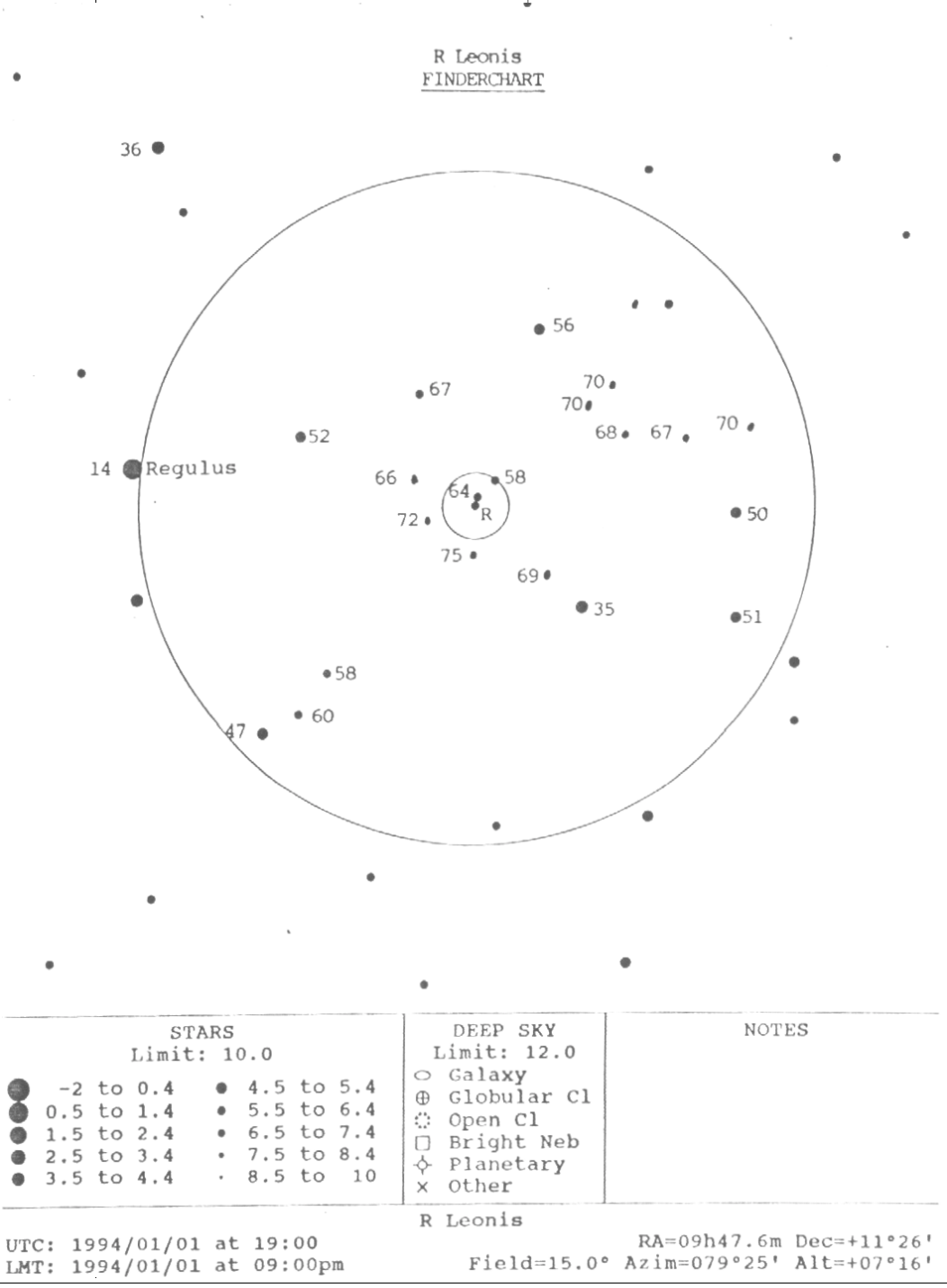
Latin equivalent of "Leo's"). R Leonis was discovered in 1782 by a German physician/amateur astronomer. It has a "period" of 313 days which means it goes from minimum brightness to maximum brightness and back to minimum in this amount of lime. R Leonis reaches a magnitude of 5.9 at maximum (rarely it may get to 4.4) and sinks to 10.1 (sometimes 11.6) at its minimum. The magnitude scale is another one of those anachronisms used by astronomers. I'll just say here that the brightest star in the sky is -1.0 in magnitude and the dimmest visible to your unaided eye is magnitude 6.0. In the city, stars of 3rd. or 4th magnitude can be visible. With binoculars, you can usually pick out 8th, or 9th magnitude stars. Therefore, with an ordinary pair of binoculars you can follow R Leonis through most of its period.

R Leonis is a pulsating red giant star as are all the Mira variables. R Leonis is so large that if we put it where our sun is, it would extend all the way out to Jupiter's orbit! Its red colour is most noticeable when R Leonis is near *minimum* brightness.

R Leonis changes brightness for two reasons. First, as R Leonis pulsates, it expands and contracts. Maximum brightness occurs when the star is smallest; minimum when it has expanded to its largest diameter. Also, it is believed that a mechanism exists which affects the amount of carbon in the outer layers or these stars. This "soot" contributes to the dimming by blocking visible light and preventing it from reaching us. As to why a Mira variable pulsates in the first place, very simply, some initial disturbance (a nearby supernova, a passing star, etc.) compresses the star's exterior slightly, increasing the pressure and temperature inside so that the star then expands beyond its initial size. The star contracts as pressure and temperature decrease. This contraction continues beyond the star's initial size and the whole process of expansion begins again. As we watch R Leonis brighten, we can imagine it shrinking in size.

R Leo (as it's known to its friends) will be about 7th or 8th magnitude in March and will climb to its maximum of 5.9 in mid May. Use the charts that follow to find it easily in the constellation, Leo, about 5 degrees west of Regulus. The stars around it have their magnitudes listed to help you estimate R Leo's brightness by comparison. The decimal points have been omitted to avoid confusion with stars. When estimating a star's brightness, try changing focus on your binoculars (or telescope). This spreads out the stars' light and helps you see more easily which is the brighter.

This year we have an added bonus to our R Leonis observations. According to Sky & Telescope, (March 1994, p.76), the



asteroid, Lactitia passes through the same field of view as R Leo during the first part of March. The asteroid, at magnitude 10.6, may be too dim to catch in binoculars, but should easily be visible in telescopes with apertures of 4" or larger.

Ann Tekatch
575-5433

Fia eoplepa ouldwa ritewa rtilciesa heta orrectca izesa Ia ouldwa otna aveha ota seua uchsa illysa hrasespa.

Optimus Editorus

Events and Announcements

◆ **April's General Meeting**
The next meeting will be on Friday April 8, 1994 in the Spectator Building, at 7:30. Come out and join the fun. We will be giving away welder's glass to members so that they can safely observe May's annular eclipse. So be sure to show up and get yours.

◆ **Event Horizon Deadline**
Send your articles, suggestions or drawings to the address on the first page by April 1, 1994. A less than serious issue is planned so please send the results of your weird imaginations.

◆ **Cosmology Discussion Group**
A meeting will be held on Saturday March 26, 1994 at 8:00 pm at McMaster in the Burke Science Building, room B149 (the Planetarium) DON'T BE LATE, as the building doors cannot be kept open. Our topic will be "Magnetic Fields." Cram you mind full of magnetic facts and attract yourself to the meeting.

Bill Tekatch
375-5433

◆ **Omega Centauri Hunt**
As you might have guessed by the picture below, we are planning to attempt sighting the greatest globular in the heavens. Stay tuned for further details.

Omega Centauri

Our new target. (300 dpi just doesn’t do it justice.)

MESSIER MARATHON CHECK LIST

CHECK	OBJECT(S)	CONST.	CHECK	OBJECT(S)	CONST.	CHECK	OBJECT(S)	CONST.
❑	M45	Tau	❑	M96	Leo	❑	M107	Oph
❑	M42	Ori	❑	M105	Leo	❑	M80	Sco
❑	M43	Ori	❑	M65	Leo	❑	M4	Sco
❑	M74	Psc	❑	M66	Leo	❑	M19	Oph
❑	M77	Cet	❑	M101	UMa	❑	M62	Oph
❑	M33	Tri	❑	M51	UMa	❑	M6	Sco
❑	M31	And	❑	M94	UMa	❑	M7	Sco
❑	M32	And	❑	M102	Dra	❑	M8	Sag
❑	M110	And	❑	M3	CVn	❑	M20	Sag
❑	M52	Cas	❑	M53	Com	❑	M21	Sag
❑	M103	Cas	❑	M64	Com	❑	M23	Sag
❑	M76	Per	❑	M60	Vir	❑	M9	Oph
❑	M34	Per	❑	M59	Vir	❑	M24	Sag
❑	M79	Lep	❑	M58	Vir	❑	M25	Sag
❑	M78	Ori	❑	M89	Vir	❑	M18	Sag
❑	M1	Tau	❑	M90	Vir	❑	M17	Sag
❑	M35	Gem	❑	M88	Com	❑	M16	Sct
❑	M37	Aur	❑	M91	Com	❑	M11	Sct
❑	M36	Aur	❑	M87	Vir	❑	M26	Sct
❑	M38	Aur	❑	M86	Vir	❑	M22	Sag
❑	M41	CMa	❑	M84	Vir	❑	M28	Sag
❑	M50	Mon	❑	M100	Com	❑	M69	Sag
❑	M47	Pup	❑	M85	Com	❑	M70	Sag
❑	M46	Pup	❑	M98	Com	❑	M57	Lyr
❑	M93	Pup	❑	M99	Com	❑	M56	Lyr
❑	M48	Mon	❑	M49	Vir	❑	M29	Cyg
❑	M44	Cnc	❑	M61	Vir	❑	M39	Cyg
❑	M67	Cnc	❑	M104	Vir	❑	M71	Sge
❑	M81	UMa	❑	M68	Hya	❑	M27	Vul
❑	M82	UMa	❑	M83	Hya	❑	M54	Sag
❑	M108	UMa	❑	M5	Ser	❑	M55	Sag
❑	M97	UMa	❑	M13	Her	❑	M15	Peg
❑	M109	UMa	❑	M92	Her	❑	M75	Sag
❑	M106	CVn	❑	M12	Oph	❑	M72	Aqr
❑	M40	UMa	❑	M10	Oph	❑	M73	Aqr
❑	M95	Leo	❑	M14	Oph	❑	M2	Aqr
❑	M63	CVn				❑	M30	Cap