HAMILTON AMATEUR ASTRONOMERS

# Event Horizon

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## Editorial

Happy New Year. I hope that the holiday season was enjoyable and relaxing. 1994 is already shaping up to be a good year. In May, Hamilton will be treated with a annular eclipse, which is reason enough to label any year good? Speaking of new, have you seen the "new" (nova) star in Cassiopeia? If not, look inside for details about this recent event.

Keeping with the new tradition this month, this issue contains the first article published as a series. This is a ploy I am using to keep you interested in reading the newsletter.

Don't you just love the winter? The recent record snowfall had me snowed in one day. While removing the white stuff from my driveway, in a state of deep relaxation similar to, but not as deep as, that state of Zen in which all seem to drive, I began asking myself important questions. Who am I? What am I doing here? And, most importantly, how much would a one my ticket to Tucson, Arizona cost? Despite the temptation to migrate to warmer climes, I remained. (Mostly due to lack of digits in my bankbook.) The next day however, high on the fumes of Absorbine Junior spread all over my body, I realized that I actually *like* it here. Where else could I find such an astronomy club filled with great, enthusiastic people who actually let me be the editor of their newsletter?

So while the weather outside is frightful, why not pour some nice hot chocolate, sit down and write something for your newsletter. As always, if you have any ideas, suggestions, articles, announcements, observations, or drawings, please pass them along to me.

HAMILTON AMATEUR ASTRONOMERS

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## Chair's Report

Happy New Year! Once again, we have had a busy, productive, and interesting month. On the unexpected side, a bright nova appeared in Cassiopeia. At maximum it was magnitude 5.3 -- technically a naked-eye nova. One of our members, Charles Baetsen, had the good fortune to photograph Cassiopeia while the nova was still brightening and before the world was notified of its existence by the International Astronomical Union (IAU) Circulars.

I am pleased to be able to report that Jim Winger's heart surgery was successful and that he has agreed to accept the position of Honourary Chair on the HAA. Jim is recovering well and recently I received a phone call from him announcing the start-up of the 1994 version of the amateur telescope makers group at his home in Caledonia this month. Look elsewhere in this issue for details.

The planetarium has been very busy in the last couple of months, thanks to Grant Dixon and his crew. The upshot of all of this activity is that the club coffers are well stocked. While we have no immediate plans for this money, we welcome suggestions of how the interests of the club might best be served by its use.

On the membership front, we now have 55 members! We also have an excellent pamphlet due to the efforts of Ann and Bill Tekatch. The HAA is also EXTREMELY grateful to Ann for the gift of liability insurance for this year -- I was rather shocked at the magnitude of this gift and I am sure that I speak for everyone an thanking Ann. (Such insurance is required by many locations before they will allow you to set up a public display or information booth.)

This month also marks our first meeting in the Hamilton Spectator Auditorium, which allows us to accommodate bigger crowds. (And the free parking does not hurt, either!)

As always, we welcome feedback on what you would like to see happen in the club and at our meetings. Please come up and chat after the meeting and let me (or any of us) know what you think!

Doug Welch

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# A New(ie) Experience

On December 11th I, a newie in astronomy, had the wonderful pleasure of hosting, or sort of hosting, an observing session. I arrived home from work at 7:30pm and was cheerfully informed by my spouse that a few of our members were braving the elements and coming to Beamsville. I sort of mumbled something unintelligible and made myself a cup of way hot, strong tea -for you see folks, it was only -6 degrees out here and with the windchill factor blowing off Lake Ontario it felt more like -16.

I was looking forward to spending some quality observing time with my new found friends but due to the fact that the clouds looked very ominous on my way home from work, I figured the whole thing had been called off. WRONG!!!! Boy, did I learn a couple of valuable lessons that night.

First of all, I take my wonderfully dark skies out here for granted. I can observe in the quiet of my back yard any clear night I choose. If I get too cold or eaten alive by bugs I can run inside and warm up or spray OFF, whatever the case may be. Convenience is only a doorstep away! I now know the importance of such phrases as: "going before you leave home" and "bundle up."

When we arrived up at Kinsmen Park the clouds were still rolling by but not away. As I drove in the parking lot with my entourage behind me (actually they didn't realize that I wasn't leading the way, but rather a couple of foolhardy, in-love, crazed teenagers ready for a night of "freezing passion"). Good timing or what, guys? As they crept out of their warm cars and I out of mine, still mumbling and clutching a mega mug of tea and by trusty binoculars, I realized how dedicated (and head-strong) they were. Not only were they prepared - they were PREPARED! After careful scrutiny of the skies they hastily returned to their vehicle and emerged within 5 minutes resembling "Nanook of the North". I was totally amazed and in awe. There I stood, shivering, in my sneakers, winter coat (the only warm thing I own), a pair of those one-size-fits-all woolen gloves that don't quite "fit all" and my daughters ear muffs that wouldn't even fit the cats ears. I did manage to find a scarf that eventually ended up on my head because Patricia informed me that that's where you lose the most heat. She said nothing about brains of course.

Now, I asked myself what kind of an idiot would stand outside in an unprotected park, the wind cold and strong enough to freeze the inside of your nostrils and gaze at a bunch of stars playing "hide-and-seek" with the clouds? A true astronomer, that's who. Not this "newie" kind, but the kind that knows what the heck they're doing.

As I looked over at Bill, and could only see the whites of his eyes, I again realized what a lot I have to learn. These people not only teach me about stargazing but about how the Eskimos must live. I'm sure if any of them were sent to Greenland, they'd survive, no problem!!!

After a very short observing session we all gratefully retired to my warm house for some serious hot chocolate drinking. It took them only 5 minutes to expel their "Nanook" look and resemble the Ann, Bill, Patricia and Ben look. My cat couldn't find her place on our bed for all their gear - she was not a happy cat.

In closing, I truly apologize for my earlier mumblings and foreboding attitude for I whole-heartily enjoyed being a popsicle for 90 minutes. It was worth it to be with some of the best and learn what I did on "winter observing." Unfortunately any list of wannabees to Santa was already made out, but watch out guys - next winter I will become the "Newie of-the North" and you will only discern me by the whites of my eyes.

Nancy Morgan

P.S. Talk about die-hards, they left my place around 11pm and ventured back to the park to observe, or freeze, or both. Dedicated or what???

# The Cosmology Corner

Richard Morris in has book "The Fate of the Universe" published in 1982, made an interesting statement. Referring to the limitations of mathematics due to Kurt Godel's proofs, he stated:

> "…the very fact that there are limits on what can be known in mathematics leads one to wonder whether there might not also be limits in physics. If there are, it seems reasonable that one would be most likely to encounter them in fields that, like cosmology, lie at the boundaries of human speculation?"

Bill Tekatch

# A New Star in the Heavens ~ Nova Cas 93

This past month a "new' star or nova appeared in Cassiopeia. Nova Cassiopeiae 1993 was discovered photographically by Kazuyoshi Kanatsu from Japan on December 7.47 UT. This observation was confirmed by the discoverer on December 11.42 UT and on both dates had a photographic magnitude of 6.5. As it turned out, the night before this discovery was announced, I took a photograph of this region, and sure enough it turned up on the photograph. Accompanying this article is an AAVSO chart of the area surrounding the nova, with comparison stars labeled for magnitude estimates (decimal points have been omitted to

# 2339+56 (b)

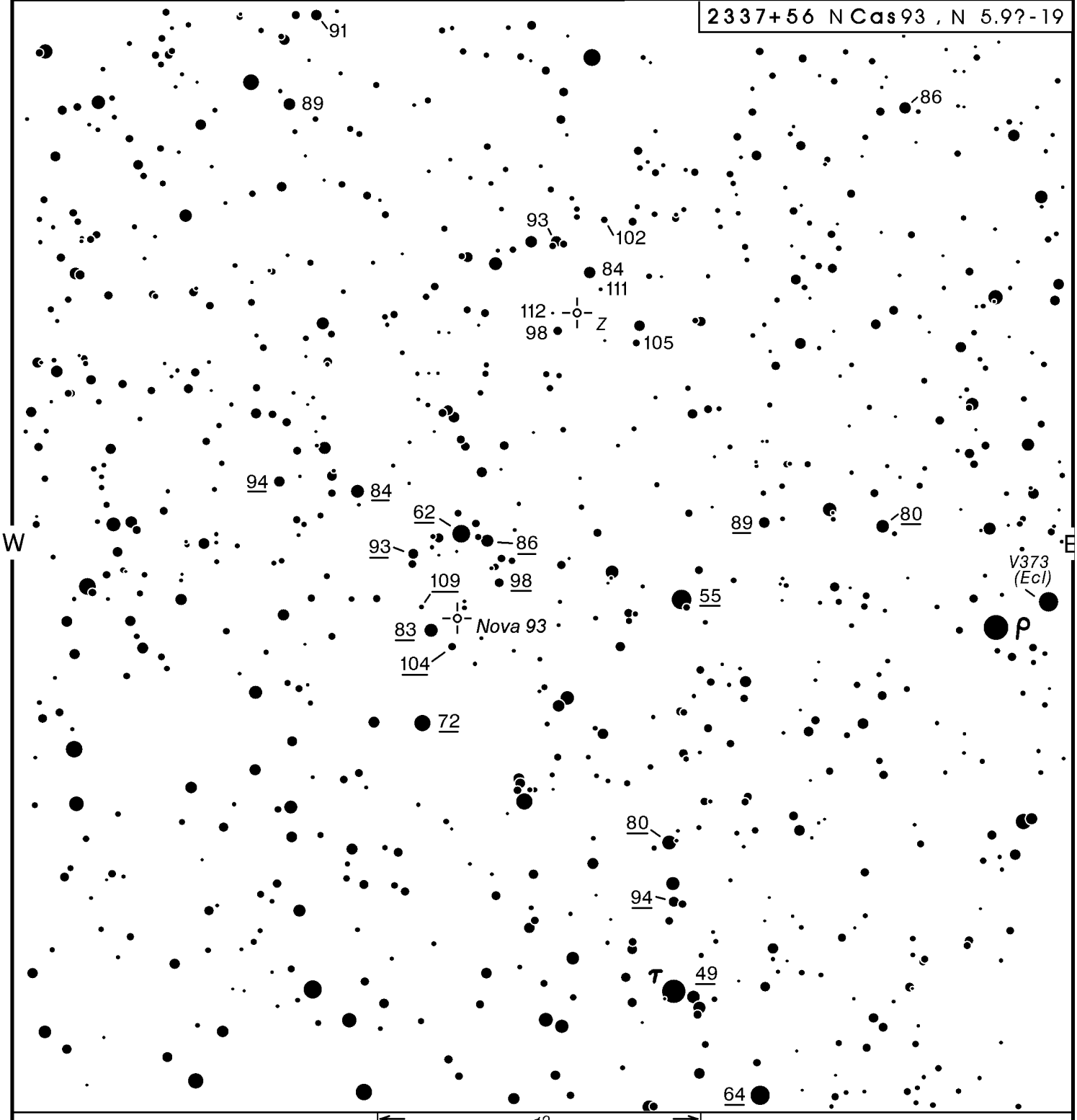
# Z Cas (Cassiopeiae)

Magn. - 8.5-15.4V
Period - 495.d71
Type - Mira
Spec. - M7e

(1900) 23h 39m 40s +56° 01'.6
(2000) 23h 44m 31s +56° 34'.9

**AAVSO Chart**
12/93
60"=1mm

2337+56 N Cas 93 , N 5.9?-19




Drawn by: CES

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From: Stamford Observatory photo

Sequence: AAVSO chart & PEP(V), Geneva Obs'y, Grenon et al; & Lowell Obs'y, B. Skiff

avoid confusion with stars), Try and watch the change in brightness over the next few weeks by comparing the nova to these stars. It should still be visible with binoculars for a while yet. The key stars used to locate this area are ρ and τ Cas. These two stars are located on any good star atlas, just south west of β Cas (these three stars form a right angled triangle)

Novae occur in close binary systems, where one member is a white dwarf. If they are close enough, the white dwarf's gravity will pull matter from the surface of the main sequence or giant companion, which in turn will settle around the dwarf. A white dwarf is generally a cool star with no nuclear fusion taking place inside its interior. As the material builds up or accretes on the surface, the gas gets hotter. When the temperature exceeds 107 K, the hydrogen ignites and fusion occurs. This process is both brief and violent. The sudden flare up causes the luminosity to brighten quickly, and then fade away as fuel is exhausted and the remainder is blown away into space. Since this process does not destroy either star, this event may occur again, hence we get reoccurring novae.

Charles W. Baetsen

# Greek in the Round

This month, we look to the sea, which has always offered a fascinating and adventurous way for all. The sky sea is no exception. The autumn sky is generally called the Water or the Sea, because most of its figures have some aquatic relation. Hence you see Cetus the Whale, Aquarius the Water-carrier, Capricornus the Sea Goat and others. When the constellations were first formed they held prominent places in the night sky during the rainy season.

There are the fishes in the sky sea, our Pisces (the northern fish) and Pisces Austrinus (the southern fish). In Greek mythology the Fishes were said to be Aphrodite and her trouble-making son Eros. The story goes that after the Olympian gods defeated the half human race of Giants, Geia, who was Mother Earth and also mother of the Giants - bore a monster son called Typhon. When he stood erect, his head scraped the clouds, and his lower legs were serpents. Typhon's arms, which could reach hundreds of miles, had snakeheads instead of hands. His eyes glowed with fire and his breath belched melted rocks and smoke.

When Mother Geia sent him against Olympus, the gods scattered as fast as they could. Eventually they wound up in Egypt, where they took on the shape of animals so they could pass unseen. Zeus, for example, became a ram, Artemis a cat, and Aphrodite a fish. When Typhon finally approached, Aphrodite snatched her son Eros, changed him into a fish too, and together they leapt into the muddy waters of the Nile. So Aphrodite wouldn't lose track of him, the story says she tied her tail to his with a silken cord. This is represented by the string of stars between the two constellations.

And Typhon? Alone among the Olympians, Athene stood firm and loudly proclaimed Zeus a coward. Shamed into action, he wounded Typhon with a bolt of lightning. Then, regaining his chariot he pursued Typhon all the way to Sicily where he finally pinned the monster, screaming with rage, by dropping Mount Etna (Greek-meaning to burn) onto him.

If you visit Sicily today, the plume of smoke from Etna's summit tells you that for Typhon, at least the last word has yet to be spoken.

P.S. - A Roman Note: Volcano comes from the Roman name Vulcan - God of Fire.

"Wish Upon A Star"
Ev Butterworth

# Planetary Rings
## *Part 1*

### Introduction

The existence of planetary rings has been known since 1659 when Christian Huygens correctly identified Galileo's "handles" on Saturn as a ring around the planet. For the next 300 years, observations of Saturn's rings added little to our knowledge of them, other than gross details such as the identification of Cassini's and Encke's Divisions and the "A", "B" and "C" rings. In 1857, James Max-

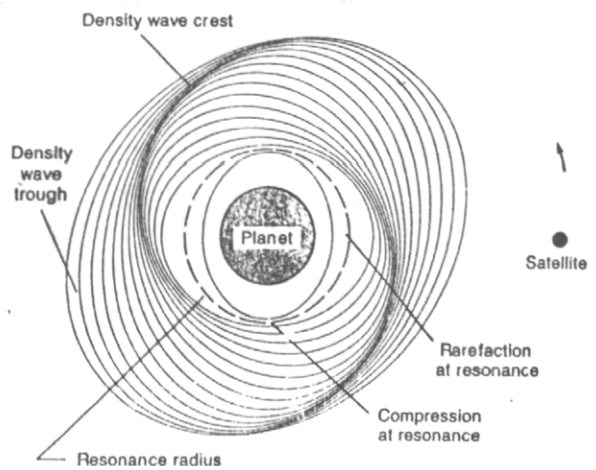


***Figure 4a.*** **This diagram shows the orbital perturbations that induce a spiral density wave. A two-armed spiral wave is excited at the 2:1 resonance (shown dashed) with the exterior moon. The ovals represent particle streamlines as seen in the frame rotating with the orbiting satellite. Their long axes become less and less well aligned with the satellite's direction at greater distances from the resonances. The clustering that occurs in the orbital paths induces coherent oscillations in neighboring particles as they drift past by Keplerian shear. Actual spiral waves are much more tightly wrapped than shown here.**

*Figure 1*

well contributed insight into the makeup of the rings by showing that they could not be solid sheets or rings of matter, but must consist of discrete particles if they were to obey the laws of Newton and Kepler. Not until recently were we able to add any significant information to these past observations and speculation.

In 1977, during an occultation of the star, SA0158687, nine rings were detected around the planet Uranus. For the first time since Galileo's observations, planetary rings were found around another planet. This discovery was shortly followed by the spectacular revelations of Voyagers 1 & 2, which showed ring systems around all four of the outer solar system gas giants. The information obtained from the Voyager missions revolutionized our understanding of planetary rings.

In this paper, I will examine the current view of planetary rings including theories on their dynamics, structure, formation and stability.

**Dynamics**

To understand the structure of planetary rings, it is necessary to first explain their dynamics That is, the processes working to maintain such phenomena as the discrete rings of Uranus; the gaps in Saturn's rings; the bright clumps (or arcs) in Neptune's ring; or why Jupiter's rings exhibit none of these features. We know from Maxwell's calculations and the two Voyagers' observations that all planetary rings consist of orbiting particles. These particles obey the same laws that the larger solar system bodies obey.

Stable orbits are achieved when the centrifugal force of an orbiting particle exactly equals the gravitational force exerted on it by the planet it circles. Imparting kinetic energy to a particle (e.g. through a collision with another orbiting particle) will allow it to move into an orbit farther from the planet. Conversely, a particle, which loses kinetic energy after colliding with another particle, will fall into an orbit closer to the planet. This is the mechanism, which is thought to eventually result in the spreading out of planetary rings as we see in Jupiter's faint and diffuse rings.

In contrast to the Jovian planetary rings, those of Saturn, Uranus and Neptune exhibit more distinct boundaries. Mechanisms must exist to maintain these boundaries and prevent the orbiting ring particles from their natural tendency to spread out. A number of different mechanisms have been proposed to account for the discrete rings and gaps found in the systems of these other planets.

The interaction between ring particles and the larger satellites (moons) orbiting these planets has been suggested to account for Saturn's Cassini Division. Saturn's moon, Mimas, orbits in a 2:1 resonance with' particles located in the outer edge of the B ring. The cumulative effect of gravitational pulls on particles located at this resonance is to force them into elliptical orbits where they collide with other particles and end up in different circular orbits. This continual sweeping of the resonant location results in an area of fewer particles and, hence, a gap is formed. Another effect of the resonant interaction is to generate spiral density waves by causing areas of particles to clump together. These denser areas have a gravitational affect on adjacent areas and a density wave is propagated through the ring disk. The clumpings of particles travel around the disk of the ring with the orbiting satellite and draw out a spiral pattern. (Refer to figure #1). Spiral density wave trains have been identified in Saturn's outer A ring by Voyager 2. This "particle clumping" does not move completely in sync with the orbiting moon, but rather is somewhat ahead of it due to the effect of gravitational interactions between the particles. This results in a net gain of energy by the moon and it eventually moves away from the planet and ring system as it slowly gains kinetic energy from the gravitational pull of the particles. The ring particles, on the other hand, slowly lose energy due to the gravitational tug on them by the moon and fall into orbits closer to the planet. This energy transfer is similar to that experienced by the Earth's tidal bulge and its moon.

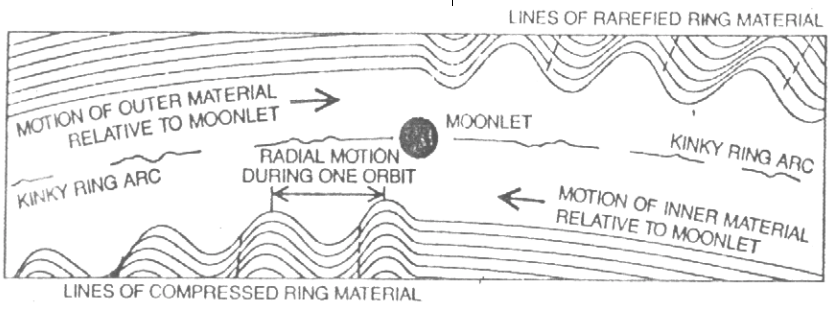


*Figure 2—Illustration how compression and rarefaction arise, as seen from a shepherding moon.*

To account for gaps in the Saturn ring system that do not occur at any known resonant location, the presence of "embedded moonlets" has been suggested. Such a moonlet is thought to exist in the A ring's Encke division and is responsible for the scalloped inner and outer edges found here. This scalloping is supposedly the result of the passing moonlet's gravitational influence on ring particles - it increases their orbital eccentricity, causing them to move inwards or outwards from Saturn and create the wavy appearance on the edge. (See Figure #2)

The narrow, well defined rings of Uranus. Neptune and the F ring of Saturn arc thought to be kept so tidy by "shepherding" moons. These moons gravitationally attract particles in the ring they straddle. In so doing, they accelerate the particles and cause them to move away into farther orbits. Because the particles are situated between two moons, they are forced into a narrow orbit between them. In Uranus' case, the rings are also highly eccentric and it is thought that this is due to the influence of these "shepherding" moons. Very simply, the initially circular orbits of ring particles

arc perturbed by the presence of a "shepherding" moon and assume an elliptical orbit. As the particles continue to interact with one another through collisions, their energy level decays and they once again fall into circular orbits.

We have seen that the ring systems around the four planets known to have them are quite different in appearance. However, the physical processes responsible for their appearances are similar.

In next month's issue, the structure of planetary rings will be examined.

Ann Tekatch

# Upward Skybound

Welcome HAA members to a new year, 1994, with a whole year's sky awaiting our pleasure. Two comets are visible this month with small telescopes. Comet Schwassmann-Wachmann 2 is well placed in the evening sky by 9:00 pm. Look between Jan. 11- 16, when it will be closest to the open cluster M44 (the Beehive) in Cancer. Also, Comet Encke in Aquarius will be 9th Magnitude on Jan. 1 and will brighten to 7th Magnitude (for binoculars), by Jan. 20. It will then be located between Alpha and Zeta Aquarii. See Jupiter (below) for details on Comet Shoemaker-Levy 9..

Saturn - is still well placed for viewing in the early evening south western sky. Do take it in this month as it is sinking fast and will disappear in February.

Jupiter - in Libra will rise in the east-southeast about 2:00 am and will be in the south by sunrise As you watch Jupiter, make special note to also watch Comet Shoemaker-Levy 9. It will be at 14th Magnitude (requiring a 12.5" scope) in January. The two objects are about 2º apart. Keep tabs on this pair.

Pluto - is in the northeast corner of Libra all year.

Open member observing nights will be held at Kinsmen Park, in Beamsville on the night of January 15th at approximately 8:00. The February observing night will be on the 12th of February, at the same location. Refer to December's Event Horizon for a map to Kinsmen park. If you are interested in attending, please contact me at 632-0163.

"Watch the Skies"
Observing Director
Ev Butterworth

# Events and Announcements

◆ **Cosmology Discussion Group**
Will meet at 8:00 p.m. on Saturday January 29. We will meet in the Planetarium (basement), Burke Science Building. McMaster University. The topic will be "the life of a star". Call Bill Tekatch at 575-5433 for more information.

◆ **Sky and Telescope Magazine Offer**
H.A.A. members can take advantage of a club discount on Sky and Telescope magazine subscriptions. The rate is $29.96 (U.S.). If you're interested, contact the treasurer, Ann Tekatch at 575-5433.

◆ **February's General Meeting**
The next meeting will be on Friday February 11, 1994 in the Spectator Building.

◆ **Amateur Telescope Makers**
Jim Winger's group will meet on January 24, February 14 and 28 at his place in Caledonia.

# Sunrise, Sunset, Sunrise, Sunset

This time of year always brings a couple of inquiries from people about sunrise and sunset times and their relationship to the solstice (Dec 21). You see, the shortest day of the year is the solstice, but this is not the date of the latest sunrise -- nor is it the date of the earliest sunset. For Hamilton, these dates are Jan 4 (7:52 am) and Dec 8 (4:44 pm), respectively. This difference of almost two weeks from the winter solstice confuses and confounds most folk -- especially those who are surprised to learn that we are closest to the sun in January!

The explanation is related to what astronomers call the equation of time. For two separate reasons, the interval between successive transits of the sun changes during the year. The first of these reasons is:

The earth's orbit as not circular, but elliptical. When we are closest to the sun the earth is moving more quickly and so the sun will mover further east in a day than it will on average.

The second factor is the tilt of the earth's axis -- the motion of the sun is not due east, except at the summer and winner solstice. Since the zero point of our clock time is set by requiring that the sun spend as much time ahead of the clocks as it does behind, in the northern hemisphere's winter the sun is further east than it would be if it moved an equal angle each day and so the sun goes down later at the solstice than you would naively expect. So the earliest sunset comes before Dec 21. For the same reason, the latest sunset is in early January.

If you think this is strange, at more tropical latitudes the times of sunset and sunrise do not change monotonically like they do here... but that is another story.

Doug Welch