Orbit

The official publication of the Hamilton Centre of the Royal Astronomical Society of Canada

March 1, 2001 Volume 34, Issue 3

Saying goodbye to MIR....
... And Looking for Messiers

Announcement:

Due to personal demands on Harry Pulley's time he has reluctantly decided to step down as president of the Hamilton Centre. For a full explanation, please see the President's Report on Page 3.

This great photo of MIR passing overhead was sent in by John Nemy.

He writes: "I'm forwarding you a photo I took last year of the MIR going over our house....This may be our last chance too see this most famous spacecraft."

John used a 50mm lens set at f1.4 for the locked down 30 - 50 second exposure, shooting on Elitechrome 200ASA slide film.

"The MIR passes over our part of Southern Ontario always appearing somewhere in the Western hemisphere of the sky as it travels East as in this photo."

Russia's Mir Space Station has been in orbit for over 15 years. A descendent of the successful Salyut space stations of the 70's and 80's the first element of MIR was launched on February 20, 1986. It is scheduled to be brought back down to Earth in mid-March.

Editorial

By: Scott Barrie

After making an excellent start to his first year as Centre president, Harry has decided to resign due to personal reasons outlined elsewhere in the newsletter.

I think we all owe Harry a vote of thanks for the many duties he has undertaken while he's been on the board and during his tenure as president. I know we all wish Harry and Allison well as they anticipate the arrival of their first child and we'll all look forward to seeing him soon under the stars.

Harry's departure will make greater demands on other members of the board, most of whom are already spread pretty thin, so if you're interested in greater involvement in the inner workings of the club, now would be a perfect time to step forward and help shape the future of the Centre.

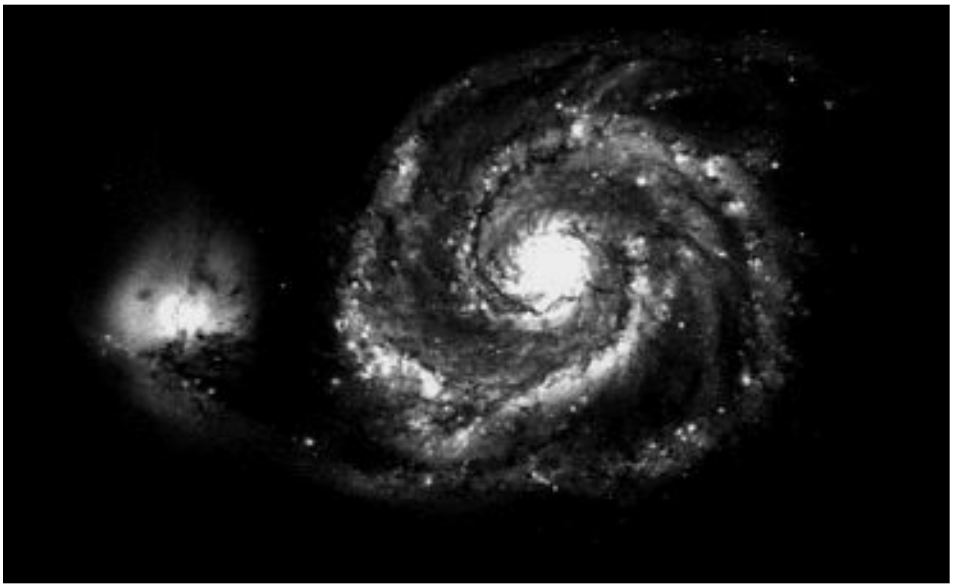

Image of M51 created with Starry Night by Sienna Software

This month promises to be an eventful one for astronomy enthusiasts. Perhaps the most significant event will be that of MIR coming back to earth after 15 years in service, and I want to thank John Nemy for sending in the excellent shot of MIR that appears on page one. I also want to thank first time contributor Gerry Cyr for his comprehensive article on star formation. As I mentioned in last months Orbit, it's member contributions that make Orbit possible.

On another front, to thousands of basketball fans across the U.S.A. March Madness refers to the NCAA college basketball championship that takes place every year. But to astronomy enthusiasts it could just as easily refer to the annual Messier Marathon.

For a comprehensive introduction to Messier Marathons please read the article on page 2. But, simply put, the idea is to try and bag all 110 Messier objects in a single night. I've been involved in a couple of marathons and, while the weather has yet to be co-operative, and, while I have yet to spot more than 30 or 40 objects, it has, without exception, always been a great time.

Nobody seems to take it too seriously and everybody enjoys helping each other out. The nights to aim for this year are the 24th and 25th of March. It would be nice if we could make it a centre event and get as many people out as possible.

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Final President's Report:

By: Harry Pulley

As some of you may know, my wife and I are expecting our first child next month. As a new father, I won't know how much time I'll have for astronomy until my life returns to some sort of routine, but I know it will be less than the time I have available now.

I feel it isn't fair to the club if the president isn't able to put in a large effort, so I have decided to resign as president of the Hamilton Centre. For the remainder of the year, the vice presidents and other board members will be running the meetings and taking care of other business.

I still hope to come out when I can but don't be surprised if you don't see me often for the next little while. I hope you all understand my reasons for leaving, and forgive me for taking the job last fall when I should have known that I wouldn't be able to fulfill it for the entire year.

M11, the Wild Duck Cluster in Scutum. Created with Starry Night

The Messier Marathon

By: Scott Barrie

Most observers love a challenge and every March the Messier Marathon fits the bill. The Messier List is comprised of 110 objects identified by Charles Messier in the 1700's. While Messier worked hard to discover comets, he compiled this list so that he could avoid mistaking the objects for new comets.

The catalog covers most of the northern hemisphere galaxies, nebulas and star clusters observable with the limited telescopes of the era.

In mid to late March, on the weekend that is closest to the equinox, the sun moves into an area of the sky nearly devoid of Messier objects and that makes it theoretically possible to find all 110 objects in one night. This year the best nights, if it's clear, will be March 24 and 25. In order to do be successful you have to have a reasonably good observing site, one with good horizons in all directions. If your view is blocked from the horizon to the East you won't find the early morning objects at the end of the list.

For many of the objects it's quick and easy to work with a small rich field scope at lower power, or even binoculars, but some of the objects are 11th magnitude galaxies and at least a 6 inch (12cm) telescope will be required to catch them. If you're interested in trying a marathon, here are some tips that you might want to keep in mind.

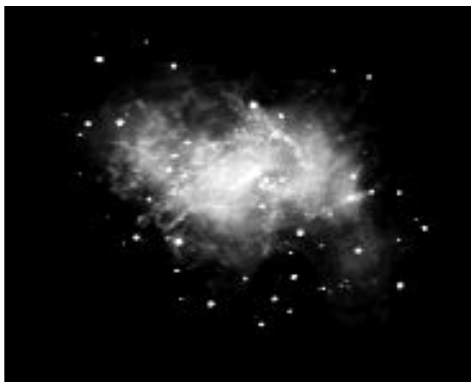
• March can be extremely cold so try and observe from a site that has some place to warm up.

• Dress properly!!! You'll need heavy, cold weather observing clothes, particularly on your feet and head. Layering is the secret to keeping warm. Wear long underwear under your pants or try using overalls such as those used for skiing or snowmobiling.

• Plan to set up before the sun goes down. Have all charts & observing aids handy from the start. Make sure you have a place to sit during the night because your body will complain if you do not. Also have some hot liquids to drink, and something to eat will help you make it through the night.

• Make sure the batteries in your red flashlight are fresh and keep some spares in a warm place.

• Start looking as soon as darkness begins to fall, don't linger over the early objects and, above all, remember to have fun. If you'd like to know more, check out the websites listed on page 7.



M11, the Crab Nebula in Taurus. Created with Starry Night

Greek in the Round:

by: Ev Rilett

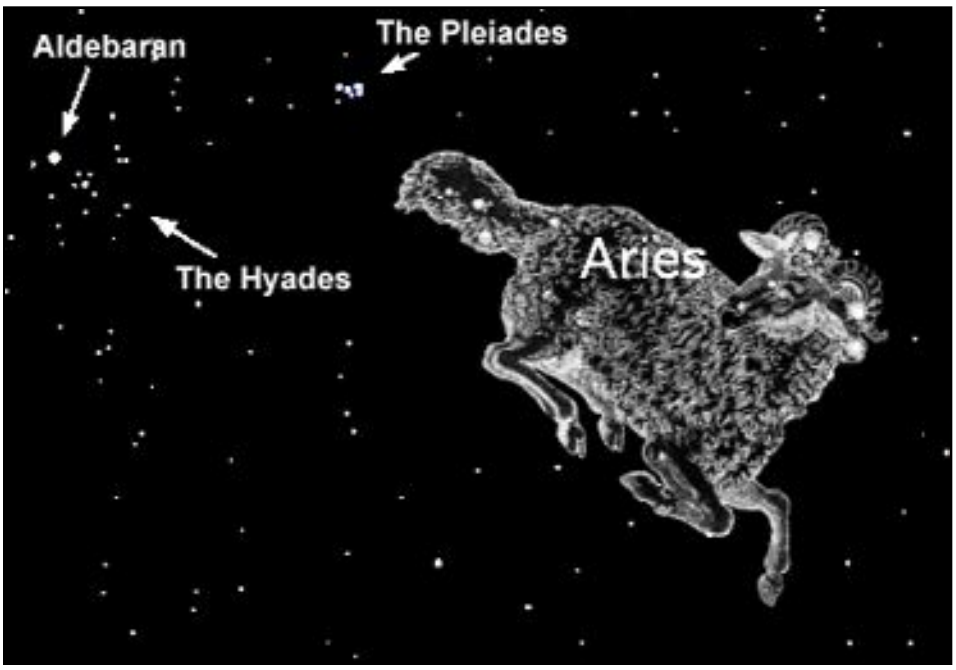
This month I'll look at Aries, an inconspicuous constellation, located in what was once an important place in the sky. Although it is small and easy to overlook, Aries has been called the "Prince of the Zodiac."

In the lore, Aries represents a Ram. In Greek mythology, it is the fabled Ram with the Golden Fleece. According to an ancient Greek legend, the Ram was sent by the god Hermes to rescue two children - Phrixus and his sister Helle - from their cruel stepmother. Helle unfortunately fell from the Ram's back as they flew across the strait dividing Europe from Asia, but Phrixus was carried to safety.

He landed in the land of Colchis, on the shores of the Black Sea, where he sacrificed the Ram and gave its precious fleece to the country's king, Aetes. Later the crew of the great ship Argo, including many of the greatest Greek heroes, set out in search of the Golden Fleece. Ultimately, after many adventures they captured the fleece from King Aetes.

By definition, the first point of Aries has 0 RA. and 0 DEC. Because procession shifts the points position over time, the co-ordinates of all the stars and other objects in the sky also shift. Between 1800 BC and AD 1, the Sun lay in Aries at the time of the Vernal Equinox, "the first point of Aries". It still bears this name, even though the Sun on the day of the Equinox has now moved into the Constellation Pisces. The first point of Aries will continue to shift and in another few hundred years the Sun will move into Aquarius.

Giving approx. millenniums (1 millennium = 2000 yrs.) the sun lay in the following constellations at the Vernal Equinox:



BC.	6000 - 4000	Gemini
	4000 - 2000	Taurus
	2000 - 1	Aries
		- Birth of Christ

Halt ASTROL/ASTRON - The Era Did Not Advance - Sayed In Aries

AD.	1 - 2000	Pisces
	2000 - 4000	Aquarius

At 1 AD. there was a halt in astronomy and astrology. The creators of myth, ancient gods and religions disappeared. Christianity was established and no one was able to manipulate the celestial vision. Instead of going from Aries into the era of Pisces, everything stayed the same except the apparent motion of the sun which shone and still shines in Pisces at the Vernal Equinox. The sun does not move into Constellations. The Earth moves around the sun and it is due to precession that the sun appears to change position on the ecliptic line.

Astronomers separated from Astrologers when Procession was realized and Astronomy was recognized as a science. Astrologers still use the stars of 2000 years ago (an unchanged ecliptic Zodiac). This means that modern astrologers use a zodiacal model that has been outdated for almost two thousand years.The current Zodiac actually has 14 Constellations. 14 you say!! Next month I'll publish the current zodiac, so you can dazzle your friends and more importantly shock all those zodiac believers out there and hopefully they'll catch on. What do you think?

"Wish Upon a Star"

A Brief Introduction to Star Formation.

Prepared by Gerry Cyr

I will give you a basic explanation of the formation of a Sun-Like star but, before I do that, it's important to have a basic understanding of the 4 fundamental forces governing all matter in the universe, in order of increasing strength.

The Four Fundamental Sources:

1. The Gravitational Force binds galaxies, stars and planets together and holds humans on the surface of the earth. Even if it is the Weakest Force, it is the most dominant in the universe. Quoting Isaac Newton (1642-1727) Universal Law of Gravitation, "Every particle of matter in the universe attracts every other particle with a force that is proportional to the product of their masses and inversely proportional to the square of the distance between them."

2. The Electromagnetic Force. Any particle having a net electric charge, such as an electron or a proton in an atom exerts an electromagnetic force. Its strength also decreases with distance and, like gravity, it obeys the inverse - square law. It attracts opposite charges or repels like charges.

3. The Weak Force. It governs the emission of radiation from radio active atoms. It is just a form of electromagnetic force acting under peculiar circumstances. It does not obey the inverse-square law. Its effective range is less than the size of an atomic nucleus, about 10^{-13} cm.

The North America Nebula in Cygnus. Photo by: Mark Kaye

4. The Strong or Nuclear Force is the strongest force. It binds atomic nuclei together and governs the generation of energy in the Sun and all other Stars. This force operates only within 10^{-12} cm of the atomic nuclei. Within this range particles are bound with enormous strength. Only when two protons are brought within 10^{-13} cm of one another, can the attractive strong force overcome their electromagnetic repulsion.

Furthermore, we have to be conscious of the Laws of Physics dealing with the Thermodynamic Temperature of Gas. The relationship between pressure, temperature and volume of an "ideal" gas (Royle's Law, Charles's Law). Basically, just be aware of the fact that when a volume of gas in the Sun is heated, it Inflates or Expands. This expansion tends to counter-balance the pull of gravity on all matter toward the center of the Sun.

The Evolution of a Sun-like Star:

Briefly:

A Star is believed to form, due to the gravitation force from the condensation of interstellar matter in an immense gas cloud. Once the cloud begins to contract its density increases and the intensity of the gravitational field therefore increases. In other words, once a gas cloud begins to contract, it must continue to contract more and more quickly. As the cloud contracts the pressure and the temperature at the center of the cloud increase.

There comes a time when the pressures and temperatures are high enough to initiate nuclear fusion; then the temperature of the cloud climbs rapidly until it becomes hot enough to radi-

Introduction to Star Formation

ate light.

At this point it is no longer a gas cloud but a star. Its central temperature has now reached 10 million degrees Kelvin (K) and its surface temperature 4,500 degrees K. At this point in time, the newly formed star is not working at full efficiency.

It will take another 30 millions years for the star to contract a little more and bring its central temperature to its full efficiency, that is up to 15 millions degrees K. Its surface temperature will raise to 6,000 degrees K and its diameter to 1,400,000 Kms. across. The Sun-like star will then have established a "Gravity - in / Pressure- out" equilibrium and will continue to fuse hydrogen into helium for the next 10 billion years.

Star Formation in More Detail

First Stage

Let us start with an immense interstellar cloud of gas and dust particles spanning one hundred Parsecs across and containing thousands of times the mass of our Sun. Once the gravitational instability begins to condense the cloud, fragmentation into smaller and smaller clouds naturally follows. This stage will last approximately 2 million years. The cloud's density is now 10^3 particles / cm 3 the central temperature is about 10 degrees K. The surface temperature is about 10 degrees K.

Second Stage

The cloud is still about 1 Parsec across. It contains approximately 2 solar masses of material. For the next 30,000 years its density will increase to 10^6 particles / cm3 , the Central temperature reaching about 100 degrees K, but its surface temperature will remain roughly the same. Fragmentation of the cloud will cease as the photons produced inside easily escape.

Third Stage

For the next 100,000 years,the cloud shrinks to roughly the size of Pluto's orbit which is about 39.5 A.U. (one A.U. equal l50,000,000 Kms. , the average distance from the earth to the sun). Its central density and its temperature reached 10^{12} particles / cm 3 and 1O,000 degrees K. The surface temperature slightly raised to 100 degrees K. By now , the opaque region in the center is consider to be a Proto-Star or near to be a Star.

Fourth Stage

For the next 1 million years, the Proto-Star continues to evolve, it shrinks and its density grows to 10^{18} particles / cm 3, its central temperature rises to 1 million degrees K, its surface temperature (now called a photosphere) is 3,000 degrees K, its size is about the size of Mercury's orbit. We can now begin to plot the surface temperature on the Hertzprung - Russel diagram.

Fifth Stage

For the next 10 million years the Proto-Star's gravitational contraction is slowed down by the increased heating. The density is $1O^{22}$ particles / cm 3, the central core temperature is 5 million degrees K, its surface temperature is 4,000 degrees K. Its size is now reduced to about 1O times the Sun's diameter (10 times 1,400,000 Kms.)

Messier Marathon 2001 - March 24th/24th

This year there will be a good opportunity to combine the Messier marathon with an all-planet marathon during the same night. If you want to learn more about Messier Marathons check out some of these websites.

- http://www.seds.org/messier/xtra/marathon/mm2001.html
- http://www.en.com/users/cygnus/holdm.htm
- http://whitethorn.house.home.att.net/messier.htm
- http://www.seds.org/billa/psc/or/mm.html
- http://www.aegis1.demon.co.uk/messlog.htm
- http://www.astronomical.org/astbook/messier1.htm
- http://www.reflector.org/MESSIER.HTM
- http://www.mjmills.fpcc.net/mm/
- http://www.askam.com/stargazer/marathon.html
- http://www.3towers.com/Marathon.htm
- http://www.corvus.com/marathon.htm
- http://hometown.aol.com/billferris/marathon.html
- http://www.cometman.com/messier.html
- http://www.skypub.com/sights/messier/mm-contest.html

Sixth Stage

Over the next 30 million years, the Proto-Star would shrink to roughly 2 million Kms in diameter. Its density 10^{25} particles / cm 3 , its surface temperature 4,000 degrees K. Now its central temperature finally reaches 1O million degrees K which is enough to ignite the proton-proton nuclear reaction (fusion), that is fusing hydrogen into helium. A STAR is born but it is not working smoothly, so it will need "fine tuning".

Seventh Stage

Over the next 30 million years the Sun shrinks to its present size of 1,400,000 Kms in diameter, its density reaches $1O^{26}$ particles /cm 3, its surface temperature stabilizes at 6,000 degrees K, and its central temperature remains about 15 millions degrees K. At this stage temperature, pressure and gravity are finally balanced. Now the Sun will run a relatively smooth burning operation for the next 10 billion years.

Eighth to Eleventh Stages

For the next 150 million years the Sun will go through turbulent periods of instability. Our star will run out of hydrogen in the center. The core is now about 14,000 Kms in diameter and fusion has ceased. The Almighty Gravitational Force will now take over.

The Gravitational energy generate by the inward gravitational pull will heat up the core. This will cause the over-laying layer of hydrogen to commence fusing into helium on the outside core of helium. The gas pressure exerted by this enhanced hydrogen fusion, increases; thereby forcing the intermediate layers and especially the outermost layers of the Sun to expand. The Star is in an unbalanced state and becomes a RED GIANT. It has swollen to about the size of Mercury's orbit.

This simultaneous shrinkage of the helium core and the expansion of the outer layer does not continue indefinitely. When the central density has risen to about 10^5 g /cm 3 the temperature in the core will reach the 100 millions K. which is needed for helium fusion into carbon.

Now the core reaches another equilibrium between the inward pull of gravity and the outward push on the gas pressure for another smooth burning operation that will last a relatively short time (100,000 years)

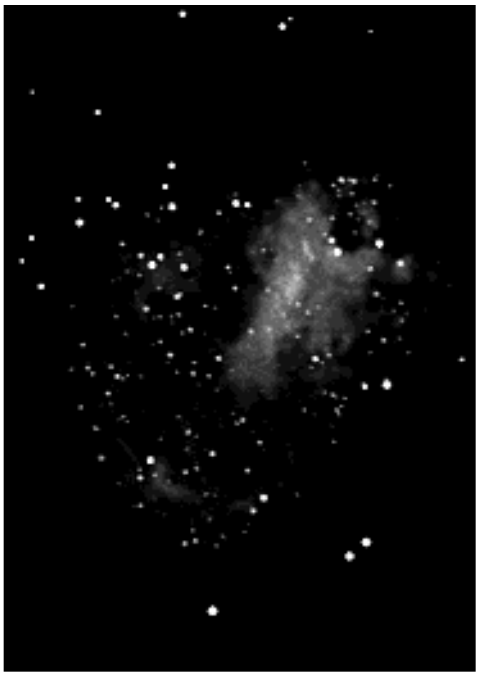
Twelfth Stage

Once the helium core has been depleted at the very center, fusion ceases. The carbon core shrinks and heats up as the gravity pulls it inward, causing the over-laying layer of helium to ignite and commence fusing into more carbon; consequently causing the over-laying layer of hydrogen to commence fusing into helium.

By now the Sun contains a shrinking carbon core with an internal temperature of about 300 millions degrees K, surrounded by a burning helium shell which in turn is surrounded by a burning hydrogen shell. Unfortunately, the Sun does not have enough mass to compress the carbon core any further, that is, in order to raise the inner temperature to 600 millions degrees K, which is the necessary temperature for carbon fusion into heavier elements. The outer envelope of the Sun expands and becomes a RED SUPER-GIANT. The Sun is now basically dead. It will eventually sheds the over laying envelopes in about 1 million years (such an object is called a Planetary Nebula). The Sun itself becomes a WHITE DWARF. It now has a diameter of about the size of the earth with a surface temperature roughly 50,000 degrees K.

I hope that helps readers to understand the inner workings of our Sun and other similar stars.

Au Revoir, Gerry Cyr.



M17, the Omega Nebula in Sagittarius. Created with Starry Night

Coming Events:

March 1, 2001 - General Meeting at 8:00pm at the Steam Museum. Stewart Attlesey talks about Carbon Stars.

March 8, 2000 - Board Meeting at 8:00 at the observatory. Come on out and help shape the future of the centre.

March 24/25, 2000 - Messier Marathon at the observatory, weather permitting. Come on out and try and spot all 110 objects on the Messier List.

April 5, 2001 - General Meeting at 8:00pm at the Steam Museum. Program TBA.

April 12, 2000 - Board Meeting at 8:00 at the observatory. Come on out and help shape the future of the centre.

May 3, 2001 - General Meeting at 8:00pm at the Steam Museum. Program TBA.

Directions to Observatory

From Hamilton or Guelph:
- Hwy 6 N of Hamilton,
- Take Concession 7 East eastbound, cross Centre Rd.
- Continue on 7E, past the rail tracks, proceed to near the end.
- Our gate is on the south side on the last lot (south west).

From Mississauga or Milton:
- Britannia Road past Hwy 25, Guelph Line, Cedar Springs to end
- South 1 block on Milborough Town Line to Concession 7 East.
- Right on 7th Concession, then first driveway on left.
- Our gate is on the south side on the last lot (south west)

From Burlington or Oakville:
- Dundas Street (HWY #5) to Cedar Springs Road
- Cedar Springs Road to Britannia Road
- Left (west on Britannia road to Milborough Town Line
- South 1 block on Milborough Town Line to Concession 7 East.
- Right on 7th Concession, then first driveway on left.
- Our gate is on the south side on the last lot (south west)

Hamilton Centre Observatory
43° 23, 26" N 79° 55, 22" W
Telephone 689-0266

Local Astronomer Discovers New Moons Around Saturn.

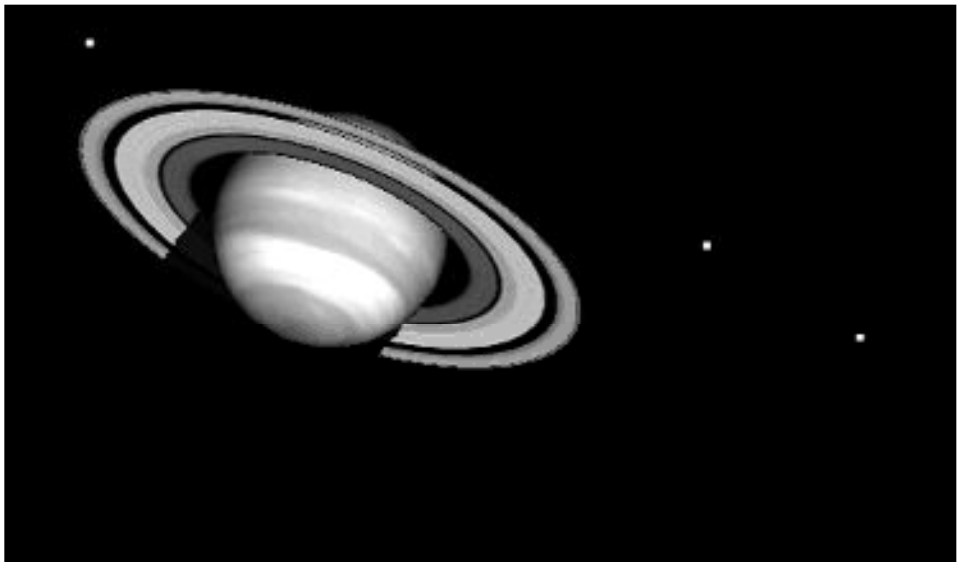
Dr. J. J. Kavelaars, a research associate in the Department of Physics and Astronomy at McMaster University was part of a team credited with discovering four new satellites in orbit around Saturn. The announcement, made last October at a meeting of the Division for Planetary Science of the American Astronomical Society, means Saturn, with 22 moons, becomes the planet with the most known satellites.

In a recent article in McMaster Times, Dr. Kavelaars was quoted as saying, “The newly discovered irregular moons are small, about 10 to 50 kms across, in line with the size of other irregular moons. They are likely icy moons, the remnants of a long-ago capture event."

The international team was comprised of a number of astronomers from several countries and they used both the European Southern Observatory and the Canada, France-Hawaii telescope.

They have discovered a total of nine satellites over the last two years.

(With information from the McMaster Times.)



Saturn and three of its moons. Created with Starry Night