Hamilton Amateur Astronomers

Event Horizon

January 2004 Volume 11 Issue 3

ASTRONOMY IN CANADA BEFORE THE CONQUEST PART I - ARCTIC EXPLORATION

Rita Griffin-Short - rgshort@spectranet.ca

Astronomy is the oldest science practised in what is now Canada, so Richard Jarrell tells us in his introduction to "The Cold Light of Dawn: A History of Canadian Astronomy". He distinguishes between astronomy 'in' Canada, and 'Canadian astronomy'. Astronomy in Canada refers to transient users and post Confederation for Canadian astronomy. I would include astronomy in New France as Canadian astronomy because since France was colonizing. The Jesuits were active astronomers, connected to the Paris Academy.

Pre conquest astronomy was practical in nature, making up 75% of our history. Canadian astronomy progressed slowly until WWII at which point it became more theoretical and abstract. Early astronomy remained tied to the needs of navigation, until Galileo aimed his telescope at Jupiter. When William Wales observed the 1769 transit of Venus from Fort Prince of Wales, he was responding to two questions: what was Earth's distance from its Sun and would knowing this complete the Kepler/Newton system. It was astronomy 'in' Canada but not Canadian astronomy.

Today, Canadian astronomers participate in astrophysical projects of major importance for the survival of our universe and thus to our species. They've come a long way!

This essay will look at early astronomy as an essential 'ingredient' for navigation, exploration and the later colonization of North America. In the beginning, Canada itself was incidental to the search for a northwest passage to the Orient, the primary aim for northern exploration. However, when the passage wasn't found, seekers turned their attention to precious metals, fish and furs with only the latter two economically useful at the early period.

The Portuguese had been exploiting the Grand Banks since the 15th c. but they did not colonize as would the French in Acadie and along the shores of the St. Lawrence while the English through the Hudson's Bay Company fur empire held sway over the north.

Bristol merchants were the first to venture into Northern latitudes. With the southern hemisphere the preserve of the Spanish and Portuguese, Britain had little choice but to be satisfied with the north. By the end of the 15th c. Bristol merchants had set up the Muscovy Company to trade with Russia while seeking a passage to China. When that failed they looked west and sent out John Lloyd in 1480 and John Cabot in 1496 without any real results. Others followed: Baffin, Davis, Hudson, Frobisher, all searching for that illusive passage to the riches of Cathay; the riches under their noses were ignored until the Hudson's Bay Company of Adventurers started exploiting furs towards the end of the 17th c. Charles II gave the company a boundless grant of land known as Rupert's Land (named for Charles's cousin Prince Rupert). It would provide a base from which the search for the northwest passage would continue for almost another 300 years!

What was the state of astronomy when the first explorers arrived in the Northern latitudes in the early 16th c.? It was primative at best and in England barely that. England was a latecomer to both astronomy and navigation expertise, but it would catch up and surpass its competitors by the mid 18th c. The west had ignored the astronomical developments of the east, it had put its faith in three individuals whose concepts would be overthrown by the end of the 17th c.:Aristotle, Ptolemy and Galen.

... cont'd on page 6

Books

This book by Kurt Forge shows how to make museum quality 3-D displays of stars near our Sun, the Pleiades, Orion, and the local group of galaxies. The book also contains a synopsis on interstellar travel that is not shown in astronomy books. Great reference material for amateur astronomers, sci-fi writers, science fair projects, and UFO enthusiasts.
`www.booklocker.com/books/1282.html`

RASC publications

Order your 2004 RASC calendars for $12 each.
E-Mail Margaret Walton `<mwalton@cogeco.ca>` to place your order.

Council meetings

All club members are welcome to attend the council meetings. Contact `info@amateurastronomy.org` for details.

HAA Pins

To commemorate our 10 year anniversary, a special pin has been created.
You can order one of these beautiful pins for $6 at the next meeting or by contacting `membership@amateurastronomy.org`

Eye Candy

This photo of the Sun was taken afocally with a Toshiba digital camera at f2.9, 1/1000; 6" reflector;Baader Solar filter; 25mm plossl with a Lumicon Light-Pollution filter attached.
Photo by Glenn Muller

Hamilton Amateur Astronomers

Event Horizon is a publication of the Hamilton Amateur Astronomers (HAA).
The HAA is an amateur astronomy club dedicated to the promotion and enjoyment of astronomy for people of all ages and experience levels.
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Chair's Report

by Glenn Muller

To start, I'd like to wish everyone "Happy New Year", and from our point of view there's little reason why it shouldn't be. Though clouds may have dominated the first few days of 2004, the last few hours of 2003 were ideal for catching Saturn at opposition. Cassini's Division was easily resolved in small scopes as were the globe's olive cap, dusky equatorial belt and several of it's moons. Also in fine form was our own Moon which exhibited long rays through the wide crater, Plato, and a lengthy shadow from the monolithic, Mons Pico.
While Mars continues to shrink in the eyepiece, all eyes remain glued to the drama of the new landers. Whether the failure of Beagle 2 increased the odds of success for Spirit and Opportunity is yet unknown but initial pictures from the Gusev Crater are encouraging and, no doubt, there are interesting times ahead. Setbacks are the nature of the beast and nature, itself, is often the cause. Our own mission to bring Saturn to the public at Bayfront Park had to be post-poned until January $24^{th.}$Still, the media did announce the opposition on December 31^{st} so our message does seem to be getting out there.
Last month, I invited reports of any new toys and here's mine: The Toshiba PDR-4300 is a 4 megapixel digital camera with a Canon lens and both optical and digital zoom. Featuring manual control of exposure settings, shutter speed, white balance and image quality, it also comes with a wireless remote control that helps to reduce vibrations when taking pictures. The instant feedback (gratification) afforded by the LCD screen reduces the uncertainty of photography, and the only picture quality problems that I've noticed have all been due to the operator. Nikon, Canon, Hewlett-Packard, Kodak, Olympus all make comparable units but what amazed me, while shopping, is how affordable advanced technology has become. And, luckily for us, that includes precision optics.
At the other end of the scale, two of my favourite Christmas gifts were books. The autobiographical "Starlight Nights" by veteran observer and comet-seeker Leslie Peltier is highly recommended for anyone with even the remotest passion for astronomy - my only disappointment was that it had to end. The other selection is "The Quirks and Quarks Question Book"; a collection of questions and answers that, over the years, have closed out the popular Quirks and Quarks radio show. Introduced by Bob MacDonald, of HAA Banquet fame, this book is another extremely entertaining and enlightening read.
Well, now I've filled my end of the bargain – it's your turn. Let us know what you've been up to by sending your observations and pictures to Anthony Tekatch. Keep an eye on the HAA website and make it a point to observe with us, soon.
Clear skies!
[Tag Line]

Glenn enjoys writing about astronomy as much as reading about it. His articles can be found at `http://home.interlynx.net/~mullers/keychron.htm`

Astronomical Highlights for 2004

Here is a list of astronomical events for the year 2004, based upon Guy Ottowell's Astronomical Calendar:

March 29: Venus and Mercury both at best evening elongation.

Apr. 3-4 : Venus grazes the Pleiades cluster.

Apr.(late) to May(mid): 2 potentially bright naked-eye comets.C/2001 Q4 NEAT will be probable naked eye in the evening sky,and C/2002 T7 LINEAR may be naked eye in low morning sky for northern-hemisphere observers, then brighter for southern hemisphere.

May 4: Total lunar eclipse, visible mainly in the Old World.

May 24: Mars-Saturn conjunction in the evening sky.

June 8: Transit of Venus across the Sun.

Sept 29: Near-Earth Asteroid 4179 Toutatis comes with 0.0103 au of Earth.

Oct. 28: Total lunar eclipse, visible from the America.

Dec. 7: Occultation of Jupiter by waning crescent Moon in predawn sky. Visible from Eastern US, and SE Canada.

by Ray Badgerow

Having a (Magnetic) Field Day

Changes in the direction of the magnetic field at the surface of the Earth are an excellent indication that something interesting is going where the Earth's influences meet those of the Sun. Many, many years ago I built my first magnetometer after reading an article in Sky and Telescope. It was a classic "Jam Jar" type. The idea was that you suspend a bar magnet by a fine thread, place a sideways-facing mirror on the magnet, and observe the direction of a reflected light source.

The "Jam Jar" has plenty of sensitivity, but requires an observer to be there all the time, which is a significant drawback. Furthermore, it is very hard to damp out the oscillations of the twisting bar magnet properly. There are obvious ways in which it can be automated - and some people have done this - but overall, anything that is capable of moving will find an excuse to move, not necessarily related to the influence you seek to measure! (This is a kind of anti-Newtonian rule!)

Fast forward to 2003. Anthony and I have a hankering to build a sensitive magnetometer using FGM-3h sensors from Fat Quarters Software and Electronics (`http://www.fatquarterssoftware.com/`) who are the North American distributors for the sensor made by Speake and Co. of England. Over the course of the fall, we trade ideas and make our initial programming attempts. Finally, after the holiday craziness dies down, we hunker down and make serious progress! By January 1st, 2004 we both have working units and i some serious software to view the results. Best yet, we are seeing real variations in the Earth's magnetic field with very good precision!

The Earth's magnetic field is quite weak compared to many of the magnets you encounter in your everyday life. So the FGM-3h is a very nice piece of hardware. It is so sensitive that if you exposed it to the full strength of the Earth's field, it saturates! So, it is usually used oriented magnetic east-west, where the strength is close to zero and the sensitivity to changes in field is greatest. Unfortunately, it is also quite sensitive to temperature! There are at least two ways to deal with this: 1) reduce temperature variation near the sensor, and/or 2) measure the temperature very precisely. We are trying to do both, but we also have a clever way of minimizing the effect of temperature: we use TWO sensors which are oriented at 180 degrees from each other. A temperature change will affect both sensors the same way, but a magnetic field change will cause them to respond in opposite directions in the signal. So by subtracting the two signals, we cancel the temperature effect and double the sensitivity to magnetic field change!

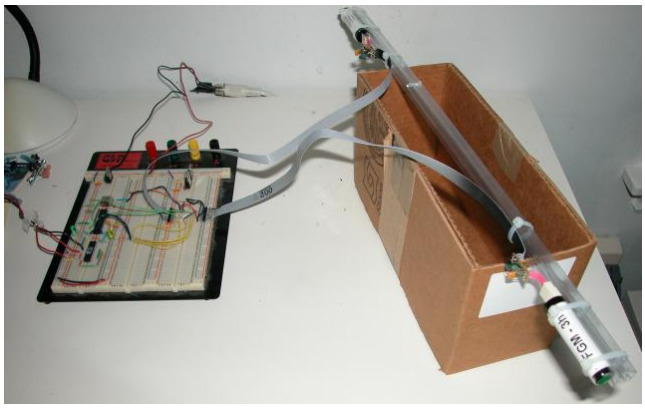

Figure 1

Our design has very few components. Let me describe these briefly.

PIC16F876: The microcontroller. It does an amazing number of things. It talks to the serial port on the computer. It has three internal timers which keep track of the passage of time and count the incoming pulses from the two magnetic sensors. It talks to two precise digital temperature sensors. It allows the selection of a number of different data collection modes. It indicates which modes it using by controlling LED's. Not bad for a CAD$12 chip!

Oscillator: This just provides a precise stream of clock pulses at close to 20 MHz.

MAX232: This takes care of the different voltages used by the PIC and your serial port. It is purely an interface device.

LM92: A very sweet (and incredibly tiny) digital sensor which returns the temperature in 0.0625 degree increments! Anthony wired these up - he must have a jeweller somewhere in his ancestry.

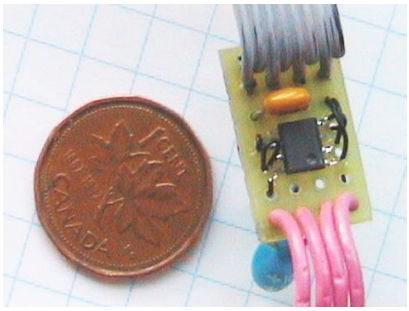

Figure 2

The software is a Tcl/Tk script. It reads the serial port, displays stripcharts of the incoming data, does data manipulation, and more.

In adjacent figures are some images and results. Figure 1 shows the prototype breadboard and sensor heads. Figure 2 is an image of the LM92 temperature sensor. Figure 3 is a schematic diagram of the circuit. Figure 4 shows a full day's recording of magnetic field changes.

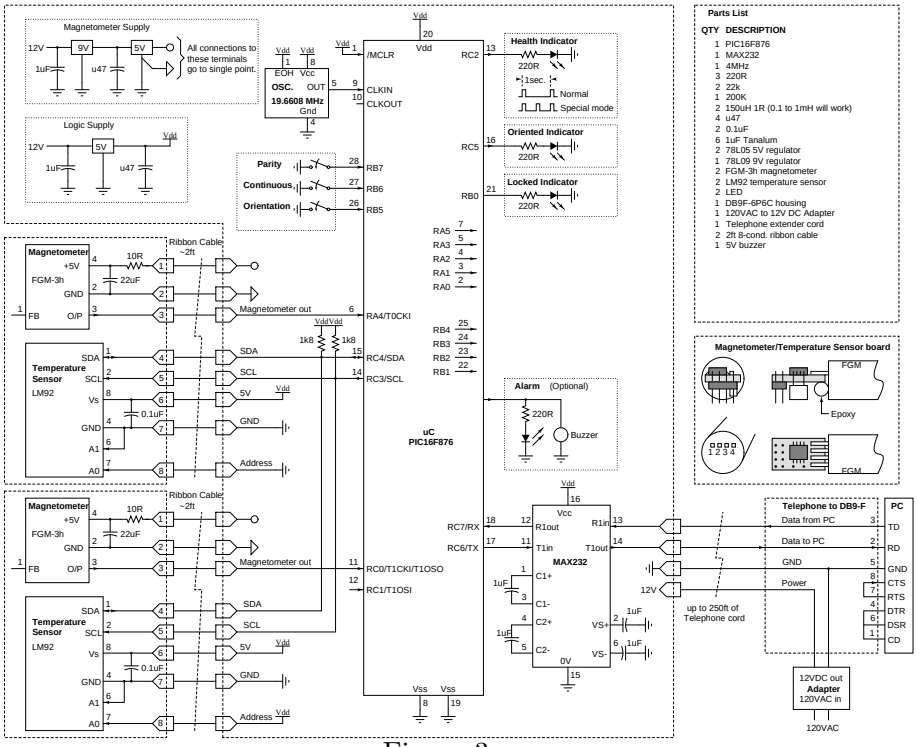

Figure 3

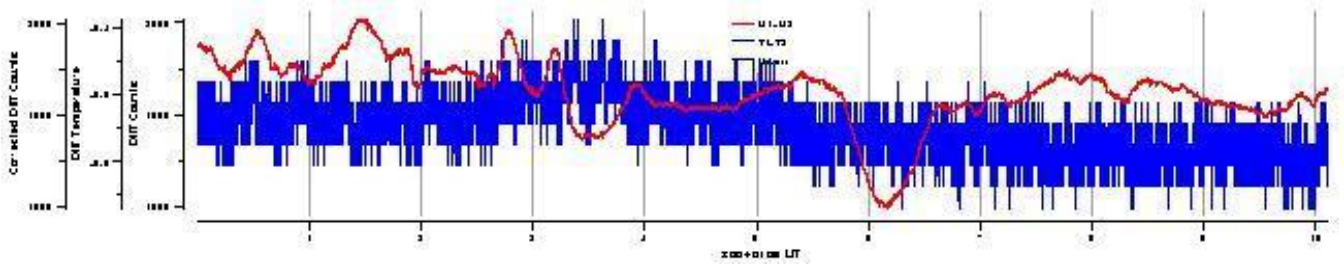

Figure 4

Among the many things we have learned so far is that a desk chair in an office can be significantly magnetized! So much so that just spinning it around a few metres away from the sensors can produce huge changes in the magnetic field!

Why do it? For one thing, the onset of a geomagnetic storm visible from your location has a very distinctive signature in the east-west magnetic field. We hope to build in an alarm for it! Another reason: it is just fun to do!

Want to know more? Check out our website! `http://crocus.physics.mcmaster.ca/Magnetometer/TW/index.html`

We'll keep you informed of our progress in improving this beast!

by Doug Welch and Anthony Tekatch

Upcoming Events

Date: January 24, 2004 7:00 PM

Event: Saturn viewing party

Location: Hamilton Bayfront park

Details: Astronomers are alerting the public to view this awe-inspiring gas giant while its rings are near their maximum tilt. Orbital motion is about to slowly close the rings, and it will be another 30 years before they are, once again, this open.

Saturn is brightest during periods of opposition, and this will happen the week after Christmas. After that, planet-watchers will have to wait until 2005 for the next one.

To take advantage of this unique opportunity. All are invited to catch the ringed wonder in what could be it's best showing of the next three decades. For more info, go to `www.amateurastronomy.org`.

Club members will be bringing telescopes and please bring your own telescope!

Date: Saturday January 10th, 2004 8PM

Event: Cosmology Discussion Group

Topic: 1950's Concepts of Interplanetary Travel and How They Are Just Being Realized Today. Includes discussion and archival footage.

Location: McMaster's Burke Science Building, Room B148 Coffee and refreshments will be provided. We welcome our members to bring a small 'entree'. Everyone welcome, open discussion. For further information, call Larry @ (905) 529-1037 or Mike @ (905) 648-8919

Date: Friday Feb 13, March 12, 2004

Time: 7:30PM

Event: Future HAA meetings

Location: The Hamilton Spectator building

... cont'd from page 1

English cosmology was steeped in the Ptolemaic system when Roger Bacon, the 13th c. Franciscan began elaborating his ideas on philosophy, logic, optics, experimentation and the primacy of mathematics. He had access to the Arabic texts that were beginning to filter into European intellectual circles, e.g. Al- Hazan and A-lKindi. He experimented with magnifying glass, microscopes, telescopes, and gunpowder. He was called Doctor Mirabilis but the church wasn't amused with his ideas and kept him in prison for years, suppressing his works. Doesn't this have a familiar ring? Had his ideas been explored and considered science would not have languished in ignorance for so long.

It is not clear if Roger Bacon, who died age 72 in 1292 in his monastic cell in Oxford, knew about the astronomical studies carried out by John of Worcester during the early 12th c. John spent much of his time observing and recording the cosmos. Monastic works in Latin and Arabic are still being discovered in libraries in spite of war, neglect and looting.

Francis Bacon, on the other hand, was of a theoretical bent, but still operating in a pre Copernican world view. His 16th c. contemporary William Gilbert, considered to be the father of electricity (brother to the explorer Humphrey) was developing his work on magneticism, "de Magnete", and Dr. John Dee, another contemporary was opening the first window for a more enlightened view of the world through geography, mathematics and navigation. They were leaving, or trying to leave, alchemy, astrology and superstition behind even though queens Mary and Elizabeth insisted on having Dr. Dee. draw up their horoscopes!

Dr. Dee, a Greek scholar, studied philosophy and logic at Cambridge. He pleaded for astronomical studies that studied the true sizes and distances of cosmos. He theorized about attraction and repulsion as seen in the lodestone of magnetized iron ore. Elizabeth was fascinated with his ideas and experiments, visiting him often at his Mortlake estate on the Thames, offering her protection from persecution. Mathematics were still thought to be tied to magic and thus the devil's work! He encouraged Elizabeth to sponsor voyages to the New World. This was the age of Raleigh, Frobisher, Drake and other adventurous fellows, who essentially were adventuring in the dark. They would not be able to pinpoint their longitude, nor be able to measure a degree of longitude because the concept had not yet been agreed upon!

Dee had studied in Louvain under the cartographers

Frisius and Mercator whose charts and maps he had copied. These he brought back to England along with a globe and improved instruments. One was a "radius astronomicus", a great cross-staff, 10'long, mounted on a stand itself scaled. He improved the quadrant, designing and making, possibly with Richard Chancellor, pilot and navigator, a 5' quadrant, scaled diagonally to measure zenith distances for new declination tables. Chancellor would use these for his voyage along Russia's northern coast in 1553 seeking a navigable route to China. No maps or charts would be published in England for another twenty years for such knowledge was jealously guarded and often disguised. Dee would use these new instruments, tables, charts and the globe to teach the adventurers how to navigate.

In 1576, William Bourne's "Regiment for the Sea" was available in London. He included a diagram of a half dial which by drawing a piece of thread between its circumference (latitude) and diameter (length of a degree of longitude in miles) would give the approximate true length of a degree of longitude at every five- degree division of latitude. However, this work appears not to have been known to Frobisher who set off that same year.

Direction was normally established by the magnetic compass, but this could be problematic since nearby metal would interfere with its reliability and compasses differed widely in quality. Humphrey Cole was England's foremost maker of navigation instruments and it is likely that he supplied Frobisher with a large, brass, compass. Frobisher carried 20 different kinds of compasses. Each of his ships had four deck-mounted ones. Given their limitations, and despite the compass card's division into quarter points, writes, McDermott – in his excellent biography of Frobisher – with a theoretical accuracy within 0.3 of a degree, an observation within 5 degrees of true was likely the best they might achieve.

Navigation methods would remain more or less the same until James Cook's 2nd voyage when models of John Harrison's chronometer would be tested and found 'excellent'. Telescopes, ideal for measuring zenith distances on land were not that useful on a rolling ship, it the atmosphere was clouded, neither zenith nor lunar measurements could be made, but the chronometer solved the longitude problem at least for some time. What took Harrison almost 40 years to design and make, now can be done with the click of a mouse! The instruments of the 17th to 19th centuries were things of beauty, often engraved with the maker and the person for whom it was made. They sell today for extraordinary prices.

Astronomy as a useful part of the Hudson's Bay Company mandate was instigated by William Wales when he spent a year at Fort Prince of Wales. He taught some of its staff how to carry out simple land survey, including Samuel Hearne who left for his first Coppermine River journey in the fall of 1769. Wales urged the Company to add a permanent land surveyor to its payroll which it did a few years later, hiring Philip Turnor on his recommendation. It was then able to relay regular astronomical data back to London. In 1772 Wales joined Cook's "Resolution" as his astronomer, and upon his return he was appointed Master of Navigation Mathematics at Christ's Hospital School, training lads for the improved navy Samuel Pepys had envisioned when he urged Charles II to establish the Navigation School in the late 17th c. Pepys wanted a professional navy, and supported the science needed to achieve that goal.

Part II will look at Canadian astronomy as practised by the Jesuits in New France (see Broughton). They and their French colleagues were leading the field of astronomy, but not for long!

Suggested Reading

Bawlf, Samuel. "The Secret Voyage of Sir Francis Drake 1577-1580". Douglas & MacIntyre:2003.

Broughton, Peter. "Astronomy in Seventeenth-Century Canada", "Journal of the Royal Astronomical Society of Canada". Vol.75, No. 4, 1981. 175-208.

Clegg, Brian. "The First Scientist a Life of Roger Bacon". Carroll & Graf:2003.

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McDermott, James. "Martin Frobisher Elizabethan Privateer". Yale:2001.

Teresi, Dick. "Lost Discoveries". The Ancient Roots of Modern Science –from the Babylonians to the Maya. Simon & Schuster:2003.

Williams, Glyn. "Voyages of Delusion". The Search for the Northwst Northwest Passage in the Age of Reason. HarperCollins:2002.

Woolley, Benjamin. "The Queen's Conjurer". First Owl:2002/

NASA's Space Place

So Little Time, So Many Galaxies

by Dr. Tony Phillips

Fourteen billion years ago, just after the Big Bang, the universe was an expanding fireball, white hot and nearly uniform. All of space was filled with elementary particles and radiation. "Soupy" is how some cosmologists describe it.

Today the universe is completely different. It's still expanding-even accelerating-but there the resemblance ends. The universe we live in now is "lumpy." Great cold voids are sprinkled with glowing galaxies. In galaxies, there are stars. Around stars, there are planets. On one planet, at least, there is life.

How we got from there to here is a mystery.

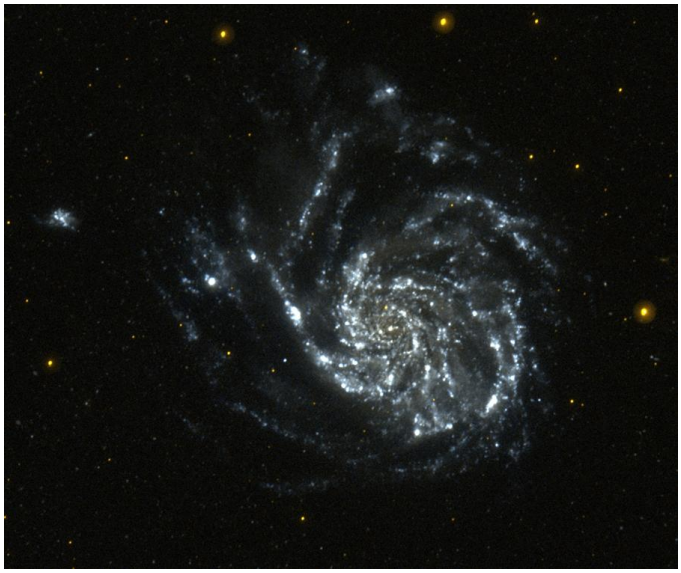
Finding out is the goal the Galaxy Evolution Explorer, "GALEX" for short, a small NASA spacecraft launched into Earth orbit April 28, 2003. GALEX carries an ultraviolet (UV) telescope for studying galaxies as far away as 10 billion light-years.

"GALEX is a time machine," says astronomer Peter Friedman of Caltech. Because light takes time to travel from place to place, pictures of distant galaxies reveal them as they were in the past. "GALEX is investigating the evolution of galaxies over 80% of the history of our universe."

The Hubble Space Telescope can see faraway galaxies, too, but GALEX has an advantage: While Hubble looks in great detail at very small regions of the sky, GALEX is surveying the entire sky, cataloging millions of galaxies during its 2-year mission.

GALEX is a UV mission for a reason. Friedman explains: "UV radiation is a telltale sign of star birth." Stars are born when knots of gas condense in interstellar clouds. The ones we see best are the big ones-massive stars that burn hot and emit lots of UV radiation. "These stars are short-lived, so they trace recent star formation."

Understanding star formation is crucial to studies of galaxy evolution. When galaxies collide, star formation surges. When galaxies run out of interstellar gas, star formation wanes. In galaxies like the Milky Way, spiral arms are outlined by star-forming clouds. The shapes of galaxies, their history and fate – they're all connected by star formation.



This image of Messier 101 (M101), aka the "Pinwheel Galaxy," was taken in two orbits of GALEX on June 20, 2003. M101 is 20 million light years away.

Even life hinges on star formation, because stars make heavy elements for planets and organic molecules.

"Our measurements of UV radiation will tell us both the rate at which stars are forming in galaxies and the distances of the galaxies," says Friedman.

How did we get here? GALEX will show the way.

Find out more about GALEX at `www.galex.caltech.edu`. For children, visit The Space Place at `spaceplace.nasa.gov/galex_make1.htm` and make a beautiful galactic mobile while learning about some of the different shapes galaxies can take.

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

February 2004

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
1	2	3	4	5	6	7
8	9	10	11	12	13 **HAA General Meeting**	14 Valentine's Day
15	16	17	18	19	20 **Observing Night**	21 **Observing Night**
22	23	24	25	26	27	28
29						

For observing info, call Stewart Attlesey 827-9105, Rob Roy 692-3245, Glenn and Gail Muller 945-5050, http://amateurastronomy.org/events.php

January 2004

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March 2004

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