

# Event Horizon

May 2004

Volume 11 Issue 7

## A Clear (or Cloudy) Sky Detector

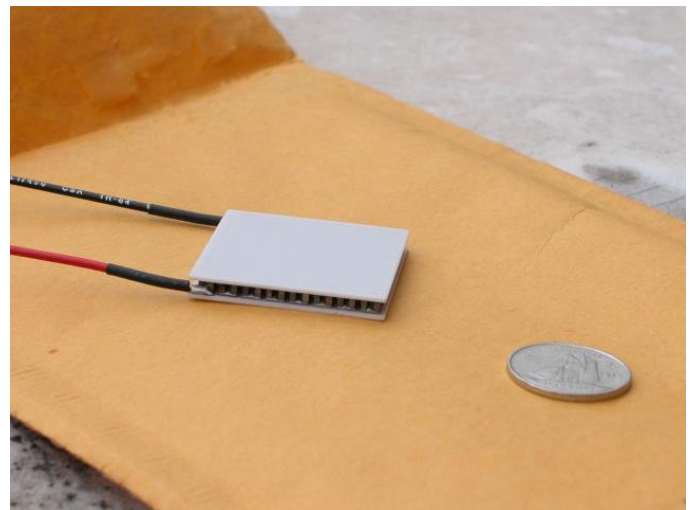
by Doug Welch

Okay - I admit it - I love building detectors! This month's entry is to establish if the sky is clear or not. You naively might think that your eyes would be up to this task. But why use your eyes when you can use **TECHNOLOGY**?! There have been an interesting number of different approaches to this over the years. Many of these have appeared in the Journal of the British Astronomical Association, presumably because of the paucity of clear skies in Great Britain! Some of the suggestions:

- A telescope pointed at Polaris - if it can detect Polaris, it must be clear! Wastes one telescope plus one observatory.
- Light reflected off of clouds from streetlights. Sadly, this probably works very well, but you need very high-gain amplifiers for the photodiodes and they are tricky. (There was an Amateur Scientist article in the April 1999 issue of Scientific American which described such a detector.)
- Sensing the temperature difference between a sensor exposed to the ground and one exposed to the sky.
- Sensing thermal radiation emitted by clouds. Here the sensor would be kept near liquid nitrogen temperature (77 Kelvin = -196 Celsius).
- Satellite weather maps - the ultimate high-tech solution which doesn't actually work very well!

The detector reported here falls in the class of looking at the difference in temperature between and upward-looking sensor and a downward-looking one - except that there aren't two sensors!

The idea for this detector came by way of a set of e-mail exchanges in the mailing list for "The Amateur Sky Survey" (a.k.a. TASS). Tom Droege's version is written up on the TASS website at <http://www.tass-survey.org/tass/technotes/tn0093.html>. There is a similar device described on the Kitt Peak National Observatory website at <http://www.noao.edu/staff/gillespie/projects/cloud-detector.html>. In both cases, a thermoelectric device known as a Peltier module is used to measure a change in temperature between the sky above and the local conditions. (If you have bought a computer in the last few years, it is a Peltier module on top of your CPU which keeps your processor cool enough to function!)



A Peltier junction and a Canadian dime.

What is the main idea here? You may have heard that every surface above absolute zero will radiate energy. That is true of the ground, it is true of the clouds, and it is true of clear sky. Fortunately for us, the temperatures of these three tend to be different from each other.

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**Chairs Report**

by Glenn Muller

Like any vibrant club, ours is member driven and this month the EH spotlight falls on four of them. I'll start with Doug Welch who has two new projects on the go. The first is an All-sky Camera station which Doug is setting up at McMaster University with Peter Brown of UWO. The second device, which he built himself, is a Clear Sky/Cloud detector. Since, at the time of writing, I've yet to see it I can only assume that the cloud part senses when I bring out my telescope! Fortunately, more illuminating details are to be found elsewhere in this issue.

From our finding fame file, don't be surprised if you catch Steve Barnes and Anthony Tekatch wearing sunglasses and saying "let's do lunch" as those two have recently received requests from different media for their artwork. Certain astrophotos of Messier objects, that Steve posted on the HAA gallery, may show up in the 12<sup>th</sup> edition of Patrick Moore's "The Amateur Astronomer", while Anthony's popular electromagnetic spectrum poster will make it's way onto the set of "Missing", a Canadian-made TV drama se-

ries. The chart will be cast as a graph on the wall of an FBI crime lab in a show that will air in September. To purchase copies of either the book or poster, just have your people contact their people at [sbarnes@skyoptics.net](mailto:sbarnes@skyoptics.net) or [anthony@unihedron.com](mailto:anthony@unihedron.com)

Finally, one member that will need sunglasses is Ray Badgerow, our inveterate eclipse chaser. On the 8<sup>th</sup> of June, Ray will view the much anticipated Venus transit from Luxor, Egypt. Naturally, we wish him clear skies and look forward to his observing report of what promises to be a fabulous trip. Meanwhile, should the sky be clear closer to home that morning, Gail and I will set up on the shore of Lake Ontario along Van Wagner's beach. Though we probably won't make it a public event, in case it's cloudy there and we decide to travel, anyone wishing to join us is quite welcome. Please remember to use safe solar viewing techniques (not sunglasses) during this event and to send your images to [editor@amateurastronomy.org](mailto:editor@amateurastronomy.org). Now let's turn off the spotlight and go catch some comets. Have a great month!

Glenn invites your comments on these topics or any aspect of the club. He can be reached via [chair@amateurastronomy.org](mailto:chair@amateurastronomy.org)



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.

The cost of the subscription is included in the \$25 individual or \$30 family membership fee for the year. Event Horizon is published a minimum of 10 times a year.

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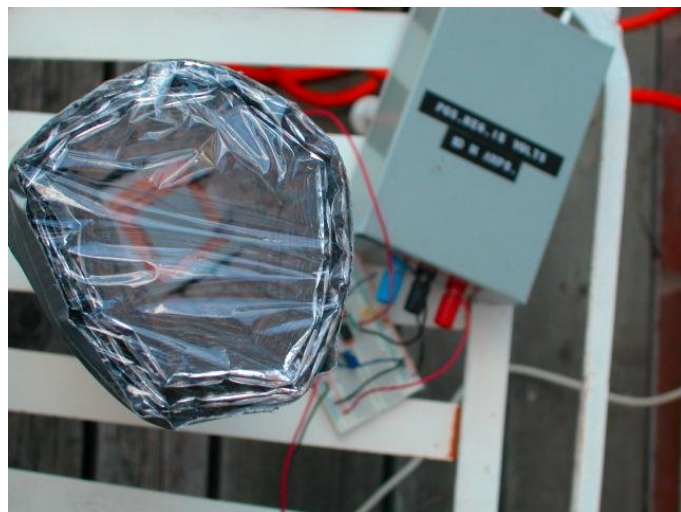
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The ground temperature will depend on time of year, obviously, but is usually between 0 and 30°C. Cloud bottoms usually hang around 0°C and clear sky will be -10 to -30°C depending on the transparency of the sky. Since the energy radiated by a surface goes as the FOURTH power of the temperature in Kelvin, these differences result in sizable differences in energy loss per unit area! A Peltier module face exposed to clear sky will lose energy much more rapidly than one exposed to cloud bottoms.

The main requirements for the detector are: 1) one side of the Peltier module must be attached to something at ambient temperature which has a lot of thermal mass. That is, the mass will change temperature slowly; 2) the other side must see sky and nothing else - no stray light from outside the beam; 3) The module, except for the block of metal serving as the thermal mass, must be insulated from the surroundings (air and heat conduction). The reason for this is that we want the only way for energy to enter or leave the Peltier module is by electromagnetic radiation. In this case, that would be by infrared light around 10 microns wavelength.

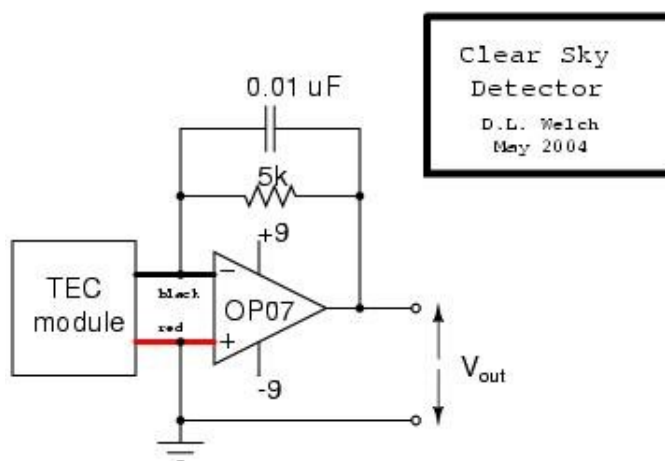


Looking down the tube of the clear sky/cloud detector. The Peltier junction can be seen mounted at the bottom. Note

the high tech Saran Wrap window and duct tape.

Okay, that all doesn't sound too hard. Styrofoam is cheap and plentiful. It turns out that Saran Warp is completely transparent in the infrared near 10 microns (unlike most other things), so we can prevent air currents from transmitting heat by having two or three Saran Wrap windows separated from each other by 25mm or more. If the Peltier module is inside a Styrofoam box, even the infrared radiation from the box can be mostly eliminated by using a cone of aluminum foil - or, better yet, aluminized mylar - to allow the module to see only the sky, directly or in reflection. All the materials so far are both cheap and easy to find!

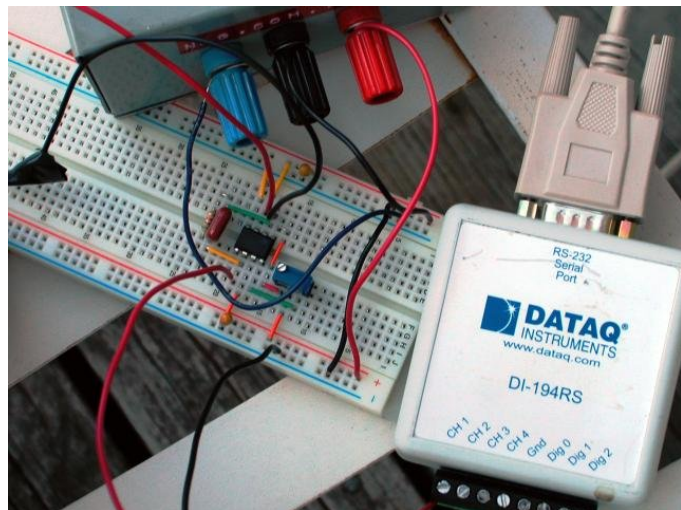
If a Peltier module has different temperatures on its two faces, a voltage will appear across its two wires. There are a number of things one could do with that voltage. Our strategy will be to use an opamp to bring the temperature difference between the two sides of the Peltier module to zero. We will measure how much current is required to do that!



Schematic

The circuit is VERY simple and robust. It requires a small, low-voltage-offset operational amplifier chip like the OP-07 and a couple of resistors and capacitors. The largest value resistor is only 5 kOhms - lots of signal,

low voltages, very robust. Obviously, you also need a power supply with both positive and negative 9 to 15 volts to feed the opamp. (If the Sun accidentally hits it, no problem.) Best of all, it works equally well during the day and the night! (See the circuit diagram below.)



The breadboarded circuit. The opamp is an OP07. The trimmer is to adjust the offset to zero volts.

How much sky should the module be allowed to see? The more sky, the more quickly the sky-face can lose energy by radiation. But you might just want to know whether it is clear or not where your camera or telescope is pointing (if it is automated). Probably a good compromise is an opening angle of about 10 degrees.

How well does it work? I'll show you at the meeting. The short answer is remarkably well! It can easily see a (warm) hand waved in front of it and a ice cube tray will drive the output the other way through many volts!

Anyone interested in making one can contact me - I have a few spare parts including Peltier modules which I would be willing to pass along at cost.

*by Doug Welch*

## WHEN ASTRONOMERS AND SAILORS SHARE GOALS, DREAMS AND ORIGINS -the story of Captain Joseph-Elzear Bernier

*by Mike Jefferson*

At first glance, it might seem odd that any writer of astronomical topics would deign to consider nautical material as something worthy of consideration. However, it should be duly noted that throughout history sailors have played an extensive role in the accomplishment of missions and projects in many areas of scientific inquiry. Rita Griffin-Short's recent writings in "Event Horizon" bear testimony to that. Astronomy was, however, not the sole scientific recipient of nautical assistance. Charles Darwin and Alfred Russel-Wallace made sea voyages in search of evidence for adaptation and 'evolution' in the world of biology. In addition, many ships have made countless journeys in aid of archaeological pursuits, meteorological research, geological theses and many other purposes.

The link between local astronomy and maritime endeavours goes back in time almost one hundred years. The first astronomical society in the Hamilton area was the Astronomical Society of Hamilton or the Hamilton Astronomical Society. It is referred to as both of these terms in the literature. It was also a child of the 147 year-old Hamilton Association. It began in 1901 and remained with the Association until 1909 when it became a satellite of the Royal Astronomical Society of Canada. Local autonomy was lost to national agendas and by 1993 the Hamilton Amateur Astronomers

formed to counteract this trend. This author believes that there is a case for a very strong tie among the Hamilton Amateur Astronomers, the Hamilton Astronomical Society and the maritime connection. What is that attachment?

Our discussion should begin with the status of both the HAA and the HAS. Each was and is an independently operating organization. Such standing confers character on the two bodies in question as they are (were) not required to adhere to some much larger formality. This trait is easily recognized in the Hamilton Amateur Astronomers as it retains the capability of "laughing at itself" in many instances and is easily the friendliest group of its kind in the area!

For many years the fame of a prominent member of the Hamilton Astronomical Society, the Reverend Daniel Brandon Marsh, has been known to local amateur astronomers. Among his list of achievements are the telescopes he constructed using his talents and the parts acquired from suppliers of optical equipment. The 5" Marsh refractor, now in the long-term care of the Hamilton Centre of the Royal Astronomical Society of Canada (and which must be maintained in working order for use by public groups through contract with the Marsh family) is arguably the 'flagship' of his optical achievements. A twin of this instrument,

the McMaster University refractor, is also in the care of said club. In addition, this group is entrusted with the responsibilities of Marsh's transit telescope, the 5" Clacey implement and the Bernier telescope. This latter, leather-armoured 3.5" instrument was constructed by Marsh for his acquaintance and 'colleague', Joseph-Elzear Bernier. As local amateur astronomers, we know next to nothing about Captain Bernier. For the last 20 years the only information about him that we have had is that he was a Canadian sea captain who sailed into Arctic waters, was a friend of D. B. Marsh and that the little leather-covered telescope is the Bernier telescope.

Captain Bernier was a very famous Canadian, indeed! The following, short biography, excerpted from The Canadian Encyclopaedia, serves to give an overview of the man and his remarkable achievements:

Bernier, Joseph-Elzear, arctic mariner (b at L'Islet, Que 1 Jan 1852; d at Levis, Que 26 Dec 1934). Captain of the government steamship "Arctic", Bernier led seagoing expeditions into the Arctic between 1904 and 1911, certifying Canada's claim to the northern archipelago. Bernier left school at age 14 to sail as a cabin boy on his father's ship. Three years later he was captain of his own ship carrying timber from Quebec to England. For 25 years he commanded sailing vessels all over the world. In 1895 Bernier became governor of the Quebec jail, a position which gave him leisure to pursue his interest in polar navigation. He devised a plan for reaching the N Pole, a feat not yet accomplished, but at the last moment in 1904 he and his ship "Arctic" were pressed into government service patrolling the eastern Arctic. On annual cruises Bernier explored the archipelago and collected customs duties from whalers and traders. (THE TELESCOPE WAS PROBABLY USED TO EXPLORE THE VARIOUS ISLANDS AND WILDLIFE VISUALLY AND TO IDENTIFY SHIPS' NAMES.) In July 1909 he unveiled a plaque on Melville I which officially

claimed the Arctic Islands for Canada. After 1911 Bernier carried on private trading on Baffin I and during WWI he commanded an Atlantic convoy ship. After the war he returned to the arctic patrol, retiring in 1925. During his career Bernier commanded over 100 ships, crossing the Atlantic 269 times. He knew more about navigating the difficult arctic waters than any contemporary mariner. His 3 "Reports on the Dominion Government Expeditions to the Arctic Islands and Hudson Strait, 1906-1910 (1910-1911)" are classics of Canadian arctic literature. -DANIEL FRANCIS

A PICTURE SHOWING BERNIER LEAVING QUEBEC ABOARD THE "ARCTIC" IS DESCRIBED AS FOLLOWS: Bernier commanded sailing ships all over the world. In 1904 he and his vessel "Arctic" (shown here leaving Quebec City) were pressed into service to patrol the eastern Arctic (courtesy National Archives of Canada/ PA-133369, photo by E. Livernois).

How is it that we have known so little about this man? The answer is that he is too good! Anyone or anything that achieves this kind of status in Canada is always conveniently overlooked. This has been the case with Captain Bernier. His skills as a master mariner, a celestial navigator and an arctic pilot were unsurpassed at the time and it is doubtful whether anyone since has been successful at exceeding him in these. More about him, D. B. Marsh and the Hamilton Astronomical Society can be found in the Special Collections section of the Hamilton Public Library and by logging on to the Internet at [www.nlc-bnc.ca](http://www.nlc-bnc.ca) and doing an nlc search.

In the 1980's a very enthusiastic, local amateur astronomer, the late Ian Stuart, used to get great fun from quips, puns and Captain High Liner jokes during long observing sessions. In fact, much of Ian's humour had a nautical air about it. So.....is Captain Bernier the real High Liner for the local amateur astronomical community? "Arr Billy!" - Quo ducit Urania,

by Mike Jefferson

## For Sale

Bushnell 4.5" diameter telescope, w/ barlow lense, eyepieces, sighting scope, good condition, lightly used. Paid \$140 will sell for \$65 o.b.o Contact Bill 905-523-1861.



## Voyage to a Double Planet

By Patrick L. Barry and Dr. Tony Phillips

Download a “nine planets” screensaver for your computer with spectacular photos of our solar system, and you’ll notice that one planet is conspicuously missing: Pluto. Icy and mysterious, Pluto is the only planet never visited and photographed by NASA space probes.

In fact, the clearest image we have of Pluto is a tiny, pixelated blob of light and dark patches taken by the Hubble Space Telescope in 1994. It’s tantalizing but not much more. Earth-based telescopes have succeeded, however, in discovering one amazing fact: Pluto is not a lone world, but a double-planet system. Its companion, measuring about half the size of Pluto itself, is named Charon.

Work is underway to launch a robotic probe to visit and photograph Pluto and Charon. The project, called New Horizons, will map both worlds. Sensors will chart surface minerals and ices, and catalog the gases that make up Pluto’s wispy atmosphere.

“It’s the second epoch in the exploration of the planets,” says Alan Stern, the principal investigator for New Horizons at the Southwest Research Institute in Colorado. “We’re going to the very edge of the solar system.”

The probe is scheduled to launch in January 2006. Its journey will be a long one. Pluto is more than 30 times further away from the Sun than Earth is! Even with a speed boost from a flyby of Jupiter, the probe won’t arrive at Pluto until July 2015. Afterward, the probe will venture on to explore the Kuiper Belt, a distant “halo” of small, frozen objects surrounding the solar system, from which comets originate.

Aside from sheer curiosity about these distant worlds, scientists are motivated by questions about the formation of the solar system. Orbiting in the deep freeze far from the sun, Pluto and Charon have undergone less change than the inner planets during the solar system’s 4.5 billion year history. These two worlds will provide a glimpse into the past.

Pluto could also shed light on the origin of our own Moon. Earth, with its single, large moon, is unusual. The Pluto-Charon system is the only other pair like it in the solar system. In fact, some astronomers consider Earth and the Moon to be a double planet, too. So

knowing more about Pluto and Charon could give clues about how the Earth-Moon system formed.

And, of course, the spectacular, up-close photos of Pluto and Charon are going to look great as a screensaver!



Artist’s idea of the New Horizons spacecraft flying by Pluto and its moon, Charon . (Credit: Dan Durda.)

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

### Council meetings

All club members are welcome to attend the council meetings. Contact [info@amateurastronomy.org](mailto:info@amateurastronomy.org) for details.

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## Upcoming Events

**Event:** Venus transit

**Date:** June 8, 2004

**Description:** Venus will pass in front of the sun on June 8, 2004. With sun-safe viewing techniques, like proper filters, you can see this transit. Check the following web site for instructions on safe sun viewing.

**Site:** [http://sunearth.gsfc.nasa.gov/sunearthday/2004/vt\\_observe\\_2004.htm](http://sunearth.gsfc.nasa.gov/sunearthday/2004/vt_observe_2004.htm)

**Event:** STARFEST

**Date:** AUGUST 19th-21st

**Location:** Mount Forest

**More info:** [www.nyaa-starfest.com](http://www.nyaa-starfest.com)

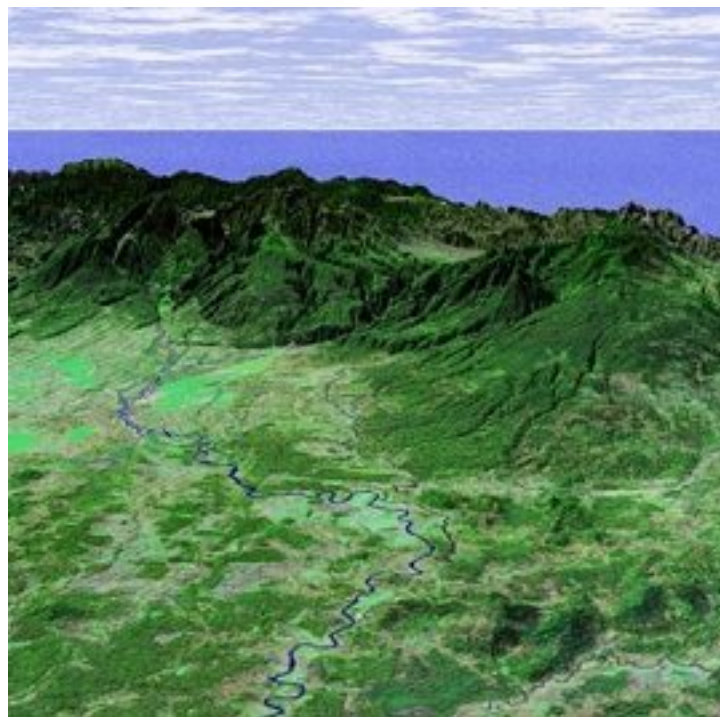
## Web Watch

Science @ NASA



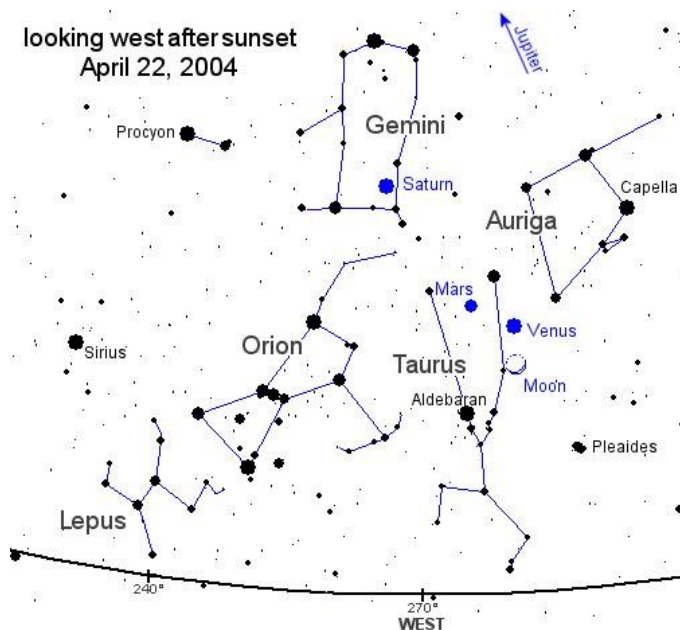
**Description:** A Pocket of Near-Perfection

**Site:** [http://science.nasa.gov/headlines/y2004/26apr\\_gpbtch.htm](http://science.nasa.gov/headlines/y2004/26apr_gpbtch.htm)



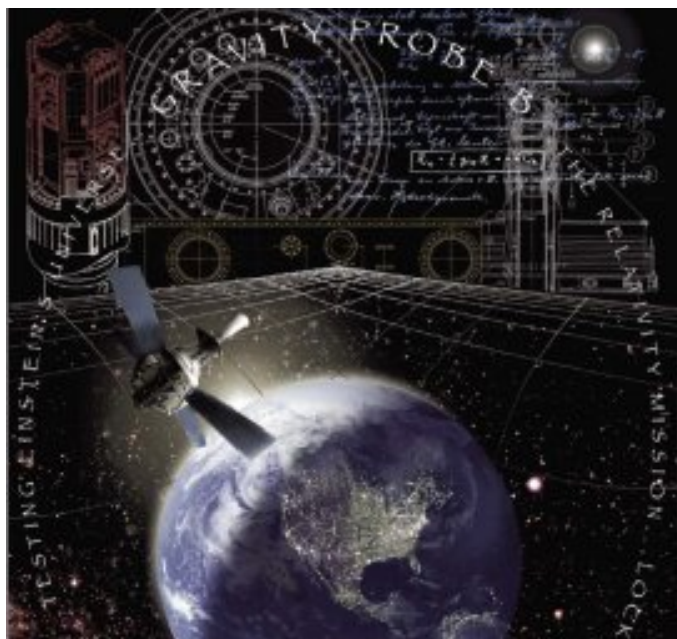
**Description:** Keeping an Eye on Central America

**Site:** [http://science.nasa.gov/headlines/y2004/23apr\\_biocorr2.htm](http://science.nasa.gov/headlines/y2004/23apr_biocorr2.htm)



**Description:** A Gathering of Planets: Part II

**Site:** [http://science.nasa.gov/headlines/y2004/21apr\\_planets2.htm](http://science.nasa.gov/headlines/y2004/21apr_planets2.htm)



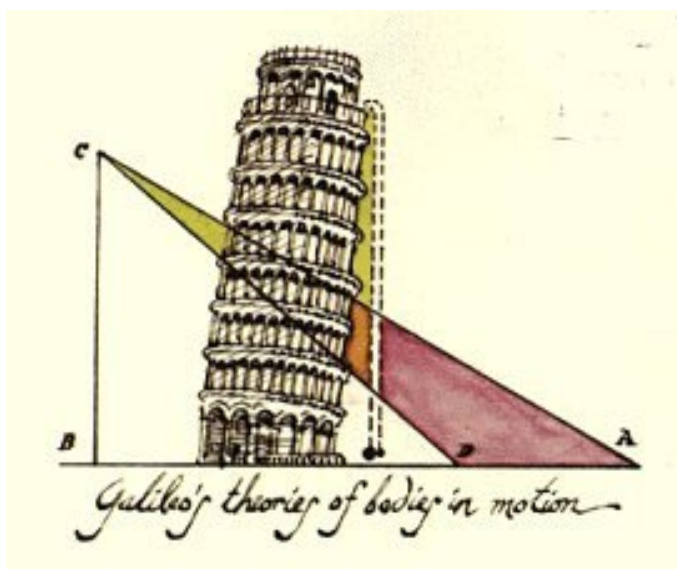
**Description:** In Search of Gravitomagnetism

**Site:** [http://science.nasa.gov/headlines/y2004/19apr\\_gravitomagnetism.htm](http://science.nasa.gov/headlines/y2004/19apr_gravitomagnetism.htm)



**Description:** UFO Planet

**Site:** [http://science.nasa.gov/headlines/y2004/03may\\_maximumvenus.htm](http://science.nasa.gov/headlines/y2004/03may_maximumvenus.htm)



**Description:** Was Galileo Wrong?

**Site:** [http://science.nasa.gov/headlines/y2004/06may\\_lunarranging.htm](http://science.nasa.gov/headlines/y2004/06may_lunarranging.htm)

### X-Prize



More than 20 teams from seven countries have registered to compete for the \$10 million X-Prize.

The rules to this contest are to build a space vehicle that is privately funded, reaches an altitude of 100km with three people aboard, and be able to fly twice within two weeks.

New Mexico has been chosen for X-Prize festival held in the summer of 2006.

For more information, visit [www.xprize.org](http://www.xprize.org)





[www.perceptor.ca](http://www.perceptor.ca)



[www.main-sequence.com](http://www.main-sequence.com)



[www.fireflybooks.com](http://www.fireflybooks.com) and Terence Dickinson



[www.mec.ca](http://www.mec.ca)



[www.camtechphoto.com](http://www.camtechphoto.com)



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[www.oneilphoto.on.ca](http://www.oneilphoto.on.ca)



[www.meade.com](http://www.meade.com)



[www.skyoptics.net](http://www.skyoptics.net)



[kendrick-ai.com](http://kendrick-ai.com)



[www.skypieces.com](http://www.skypieces.com)



[www.starlight-theatre.ca](http://www.starlight-theatre.ca)



[www.khanscope.com](http://www.khanscope.com)

# June 2004

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