

POLARIS



Royal Astronomical Society of Canada
London Centre Newsletter
March 2009

Why Photons Have Frequency Mark Ingram

Photons are the force carriers of the electromagnetic field.

This means that photons are the reason and method by which charged particles repel or attract each other.

Einstein discovered (and got the Nobel Prize in 1921 for) the photoelectric effect, the property of materials (usually metals) whereby incident photons cause electrons to fly off.

A brief but essentially accurate explanation is that electrons are "bound" to nuclei in certain fixed areas loosely termed "energy levels", and a photon (in precise circumstances) can be absorbed one of these electrons, but *only* if that electron moves to an energy level exactly as much higher (in energy) as the energy of the photon it absorbed. And in perfect symmetry, an electron can drop (sometimes spontaneously) to a lower energy level, but it can do so only if it emits a photon, again of the exact energy difference.

An interesting way to look at this is to note that, since electrons have a negative charge, moving the electron to a different energy level *changes the electromagnetic field*, and since changes in the EM field are carried by photons,

this means it either creates or absorbs a photon.

So, photons have energy. And, it turns out, the only property of a photon that determines how much energy it has is its frequency, which by the way cannot be zero. The higher the frequency, the higher the energy.

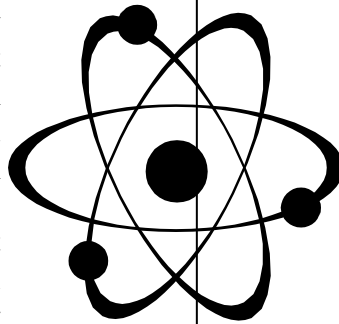
OK, now to the fun part. Photons are elementary particles, which means they are created or destroyed all-at-once, that is, there is no such thing as a half-created photon.

Equivalently, and this requires some thought, no photon can be created in less time than is needed for that photon to vibrate through one complete wavelength.

But what this means is that the frequency determines, and is determined by, the time span (duration) of the event that created the photon! In other words, high-energy photons (like gamma rays or X-rays) are produced only by high-speed interactions, and low-energy photons (like radio waves) are produced only by (relatively) low-speed interactions.

I don't know exactly why I do, but I find it fascinating that I can look at a photon from a distant star and know the length of time it took for the interaction that produced it to do so.

Next time: The Wonders of Polarization!



Moon Phases



March 26 2009



April 2 2009



April 9 2009



April 17 2009

Facts from the Editor

Here is list of photon frequencies for comparison.

AM Radio Broadcast	540 KHz to 1630 KHz
Shortwave Radio	5.95 MHz to 26.1 MHz
TV (VHF,UHF)	54 MHz to 806 MHz
Ku-band (Satellite TV)	10.7 GHz to 14.5 GHz
Infrared Radiation	300 GHz to 430 THz
Visible Light	430 THz to 750 THz
Ultraviolet Radiation	1.62 PHz to 30 PHz
X-Rays	30 PHz to 30 EHz
Gamma Rays	30 EHz to 3000 EHz

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Find the Polaris newsletters on the internet at: www.patusratus.ca/Polaris

LONDON RASC MONTHLY MEETINGS

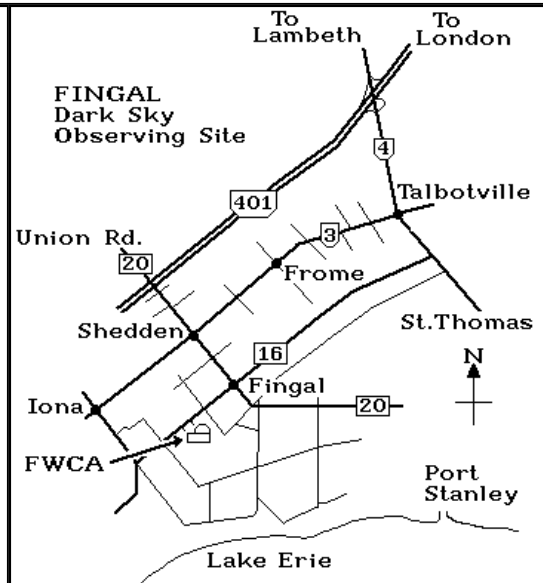
The London RASC group meets at Fanshawe college in London Ontario, September through July on the third Friday of the month at 19:00. They meet in room B1073.

Everyone interested in astronomy is invited to attend and enjoy our guest speaker, member activity and observing reports, announcements of new discoveries and upcoming events, telescopes and telescope accessories show and tell, and other fun activities. Have a look at our future and past activities on our website to see what we are doing.

Parking is free on Friday evenings, and there is plenty of room in the east parking lot off Oxford St. and parking spaces on the south side of B building. Enter the college by B building doors near Oxford Street, just west of the bus stop. College signs at key hallway locations will help you find us. The London RASC webpage can be found at:

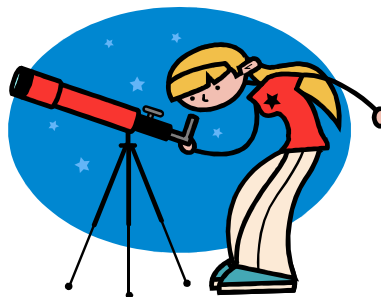
www.rasc.ca/London

They have a preferred observing site at Fingal Wildlife Management area.



Sky Events for March and April 2009

March 20 Equinox
 March 22 Jupiter 1.5° S of Moon
 March 30 Moon 0.6° N of Pleiades (M45)
 April 4 Moon 1.7° S of Beehive (M44)
 April 13 Antares 0.4° S of Moon
 April 13 Double shadow transit on Jupiter
 April 19 Jupiter 2.0 ° S of Moon



Look for comet Lulin

Jupiter is a morning planet

Saturn is in Leo and transits at midnight. The rings are only inclined 2.57°

Venus is sinking lower in the evening as the month progresses

Mars rises during twilight

R.A.S.C. London Centre Library Books of the Month March 2009 *By Robert Duff*

In order to make our library collection available to members, I bring three books to our general monthly meetings. These “Books of the Month” are available for loan, to be returned at the following monthly meeting.

The books for March 2009 are as follows:

Kepler's Witch: an Astronomer's Discovery of Cosmic Order Amid Religious War, Political Intrigue, and the Heresy Trial of His Mother, by James A. Connor. c2004.

Pale Blue Dot: a Vision of the Human Future in Space, by Carl Sagan. c1994.

365 Starry Nights: an Introduction to Astronomy for Every Night of the Year, text and illustrations by Chet Raymo. c1982.

For a complete listing of our library collection please see our RASC London Centre Web site at: <http://www.astro.uwo.ca/~rasc/>

If there is a particular book or video you wish to borrow, please feel free to contact me by telephone at (519) 439-7504 or by e-mail at rduff@sympatico.ca



Sky and Telescope Subscriptions

Sky & Telescope subscriptions are available at a discounted rate through the London Centre. The cost is \$39.95USD instead of the normal \$49.95USD subscription rate. Please see Bill Gardner for details.

Exploring the Stars, Cronyn Observatory

February 24th —March 12th, 2009

By Robert Duff

Please note that I attended most of these Exploring the Stars events and brought the RASC London Centre's 2008 General Assembly photographic display as well as copies of the book, "Mary Lou's New Telescope," "Star Finder" planispheres and extra Galileo Moment (GM) cards with me.

64th Brownies, February 24th

Graduate student Ryan Marciniak showed the IYA trailer followed by the digital slide presentation, "Constellations," and a sky tour with "Starry Night" sky charting software to the group of 33 visitors (25 children and 8 adults). The planet Venus was observed with the 25.4cm refractor in the dome and the 25.4cm Dobsonian on the roof patio. M42 was also observed in the Dobsonian. Ryan distributed GM cards and gave away two copies of the book, "Mary Lou's New Telescope" as prizes for the best questions asked.

91st London Sparks, February 25th

Graduate student Amanda Papadimos showed the IYA trailer followed by the digital slide presentation, "Earth/Moon System," to the group of 32 visitors (19 children and 13 adults). They were shown the big 25.4cm refractor in the dome but clouds and light rain ruled out any observing. This was followed by a sky tour with "Starry Night" sky charting software. Amanda distributed GM cards and gave away two copies of the book, "Mary Lou's New Telescope" as prizes for the best questions asked.

Cronyn Observatory Open House, February 28th

Clear skies and cold temperatures greeted some 100 or more visitors for the Cronyn Observatory Open House, Saturday, February 28th, 7:00—9:00 p.m. Graduate student Amanda Papadimos made two digital slide presentations to overflow audiences. People lined up in the dome as I showed them views of Venus and later the Moon through the big 25.4cm refractor. Adam Priestap-Suttis (with his father David) set up his 20.3cm Dobsonian on the Observatory's roof patio and showed visitors the Moon, the Orion Nebula (M42) and Saturn. Peter Jedicke showed people the Moon, M42, Saturn and Comet C/2007 N3 Lulin through the RASC London Centre's 25.4cm Dobsonian. Visitors were enthusiastic and asked many questions. Amanda gave out Galileo Moment cards although not all visitors received them. Two copies of the book, "Mary Lou's New Telescope," were given to keenly interested children. As with other Exploring the Stars events, I brought the RASC London Centre's 2008 General Assembly photographic display. It was a very successful evening of stargazing and many thanks go to Adam Priestap Suttis and his father David for bringing their telescope as well as to Peter Jedicke for working with the 25.4cm Dobsonian and finding Comet Lulin.

Thamesford Cubs, March 3rd

Graduate student Ryan Marciniak showed the digital slide presentation, "Our Solar System," to the group of 11 visitors (8 children and 3 adults) from the Thamesford Cubs. The night was very clear and we obtained an excellent view of the near First Quarter Moon through the big 25.4cm refractor. We

also showed them the Moon, the Pleiades, the Orion Nebula (M42) and the planet Saturn through the 25.4cm Dobsonian. Ryan distributed Galileo Moment cards at the end of a very clear and successful evening of observing.

17th Brownies, March 4th

Clear skies greeted 28 visitors for an evening of Exploring the Stars, including 21 members of the 17th Brownies accompanied by 7 leaders and parents. Graduate student Amanda Papadimos made the presentation, "Earth/Moon System." Seeing conditions were excellent and very good views of the First Quarter Moon were obtained in the big 25.4cm refractor and the 25.4cm Dobsonian. At a leader's request I also gave a constellation tour. Amanda distributed Galileo Moment cards and two of the parents took RASC London Centre brochures.

Plenty of Fish, March 5th

Graduate student Alyssa Gilbert showed the IYA trailer followed by the presentation, "Constellations," to 38 adult visitors from the group, Plenty of Fish. Since it was cloudy we showed them the lights on the communications tower in south London through the Cronyn Observatory's big 25.4cm refractor. I also showed them the top of a coniferous tree to the east through the RASC London Centre's 25.4cm Dobsonian set up on the Observatory's roof patio. Alyssa distributed Galileo moment cards. Several people took RASC London Centre brochures from in front of the RASC London Centre's 2008 General Assembly photographic display, which I had set up on the table.

Cadets, March 6th

Graduate students Alyssa Gilbert and Amanda Papadimos welcomed 61 visitors, including 57 cadets (ages 13—17) and 4 leaders, to the Cronyn Observatory for an evening of Exploring the Stars on Friday, March 6th, at 6:00 p.m. Part of the group was from Quebec and French speaking and the others were from Ontario. While Alyssa made the digital slide presentation, "Missions to Space," to the English-speaking Cadets, Amanda showed the Cadets from Quebec the big 25.4cm refractor in the dome, with one of the leaders translating into French.

Since clouds periodically obscured the Moon, Amanda proceeded with the telescope making activity in which the group assembled telescopes made with cardboard tubes and lenses. However, the sky soon cleared and Cadets enjoyed nice sharp views of the Moon in the big refractor, using the 32mm Erfle eyepiece (137X).

I invited the Cadets to test their newly made telescopes out on the Observatory's roof patio and to observe Venus and the Moon through the 25.4cm Dobsonian telescope. Through the French-speaking translator I explained the difference between a reflector and refractor telescope. They were followed by the English-speaking group who viewed the Moon, the Orion Nebula (M42) and Saturn. All objects were viewed in the Dobsonian. Alyssa distributed Galileo Moment cards and several RASC London Centre brochures were taken from in front of the RASC London Centre's 2008 General Assembly photographic display, which I had set up on the table.

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64th Guides, March 10th

Graduate student Ryan Marciniak showed the digital slide presentation, "Constellations," to the group of 17 visitors (14 children and 3 adults) from the 64th Guides. This was followed by the activity "Kitchen Comet" in which Ryan made a comet from dry ice and other materials. Clouds and some rain ruled out observing and Ryan gave them a tour of the big telescope in the dome. I explained the RASC London Centre's 2008 photo display, which I had set up on the table in the dome. Ryan finished the evening with a sky tour using "Starry Night" software and distributed Galileo Moment cards.

92nd Sparks, March 11th

Mixed clouds and clear sky greeted 28 visitors for an evening of Exploring the Stars, including 15 members of the 92nd Sparks and one small child accompanied by 12 leaders and parents. Graduate student Amanda Papadimos made the presentation "Comets & Asteroids" followed by the activity "Kitchen Comet" with Amanda making a comet from dry ice, water, dirt and molasses (to simulate hydrocarbons). While it was still daylight the group viewed a coniferous treetop through the 25.4cm Dobsonian telescope and the communications tower in south London through the big 25.4cm refractor. As twilight set in they viewed the crescent Venus through the 17mm Nagler eyepiece (67X) in the Dobsonian. Amanda distributed Galileo Moment cards and I gave one parent a RASC London Centre brochure.

Home Schoolers (8+), March 12th

Clear sky with a few clouds greeted 16 Home Schoolers, including 11 children and 5 adults, to the Cronyn Observatory for Exploring the Stars at 19:00h, Thursday, March 12th. Graduate student Alyssa Gilbert guided them through two activities, including the assembly of "Telescope Kits" and "Kitchen Comet," involving the making of a comet with dry ice. Dave McCarter and I showed them Venus and Saturn through the big 25.4cm refractor (137X) in the dome and the 25.4cm Dobsonian (67X) telescope. I also showed them the Orion Nebula (M42) in the Dobsonian. Alyssa distributed Galileo Moment cards in what was a successful evening of astronomy despite the cold weather.

Centre for Planetary Science & Exploration and Canadian Lunar Research Network, Grand Opening, February 27th, 2009

By Robert Duff

Friday, February 27th, saw the grand opening of the Centre for Planetary Science & Exploration and the Canadian Lunar Research Network in the Physics & Astronomy Building at the University of Western Ontario.

I set up the RASC London Centre GA2008 display with brochures and Galileo Moment cards in P&A Room 113, along with many other displays by contributors to the event from both on and of campus. The Space Society of London as well as the RASC London Centre took part to celebrate the International Year of Astronomy 2009.

CPSX Director Dr. Peter Brown and Deputy Director Gordon Osinski made opening remarks to a fairly large audience of faculty, students and visitors at 2:30 p.m. in

P&A Room 137. Peter mentioned that the Centre comprised some 40 faculty members spread across 10 departments on campus and included 17 graduate students.

The afternoon and evening featured talks by Greg Schmidt, Deputy Director, NASA Lunar Science Institute; Alain Berinstain, CSA Director of Planetary Exploration & Space Astronomy; and former Canadian astronaut Bjarni Tryggvason. There were also remarks by Dr. Ted Hewitt, Vice President of Research, and the Deans of Science and Engineering at Western.

The Grand Opening and Reception took place at around 5:30 p.m. in Room 113 with Peter Brown cutting two large cakes. The Reception with food and drink was sponsored by MDA.

Bob Richards of the Canadian information systems company MDA lunar and planetary rover team made the keynote address, "Odyssey Moon – Preparing for Moon 2.0," at 7:00 p.m. CBC's science commentator and advisor to "Odyssey Moon" Bob MacDonald arrived late in the afternoon and was acknowledged by the audience.

RASC London Centre member Richard Gibbens was there for the talks and Peter Jedicke arrived later in the day. I spoke with a few visitors to the RASC London Centre display and made our brochures and Galileo Moment cards available. The sky cleared on that bitterly cold evening and I called people's attention to the crescent Moon and Venus visible through the window on the west side of the room right where our display was set up.

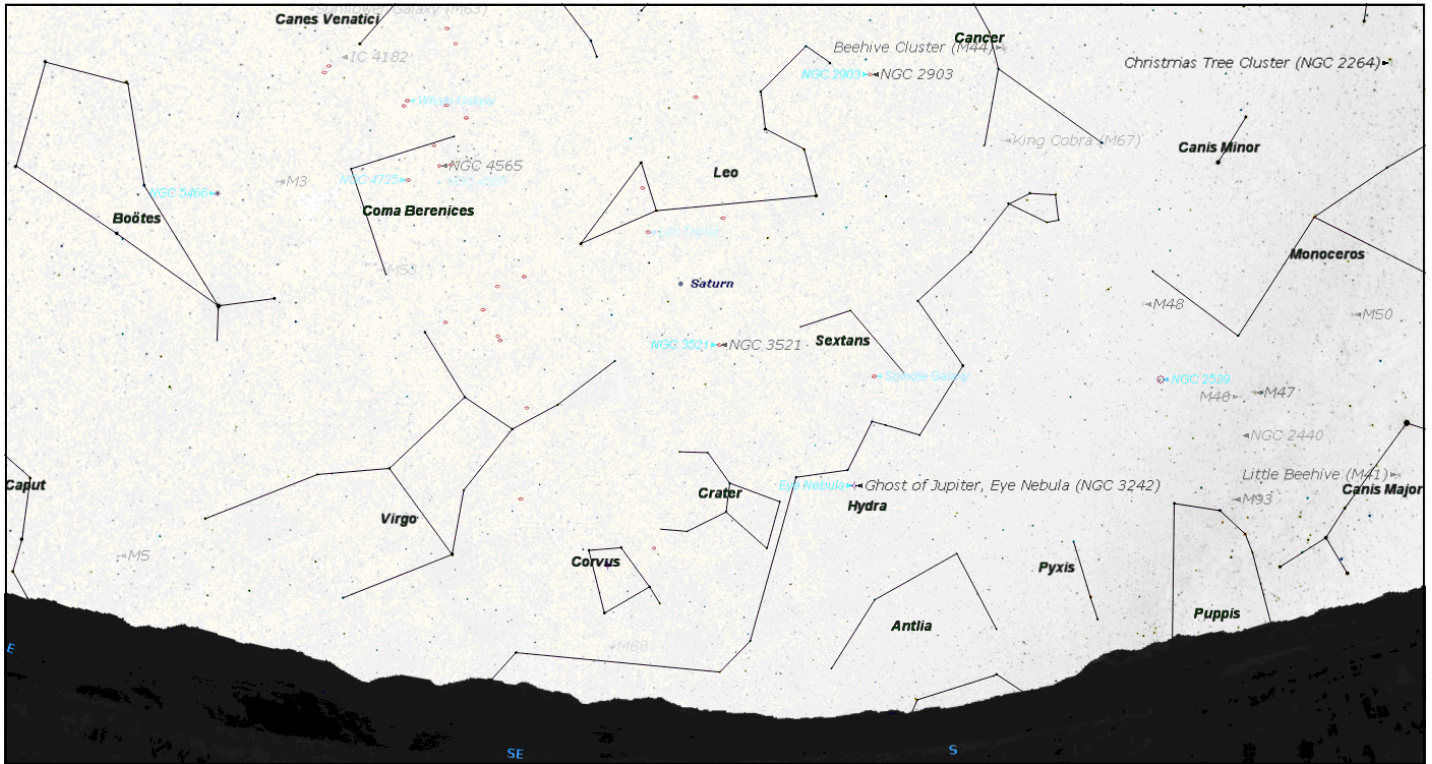
Our congratulations go to the organizers of the Grand Opening of the Centre for Planetary Science & Exploration and Canadian Lunar Research Network for a very successful event.

Astronomy Presentation, March Break Camp, White Oaks School, March 16th, 2009

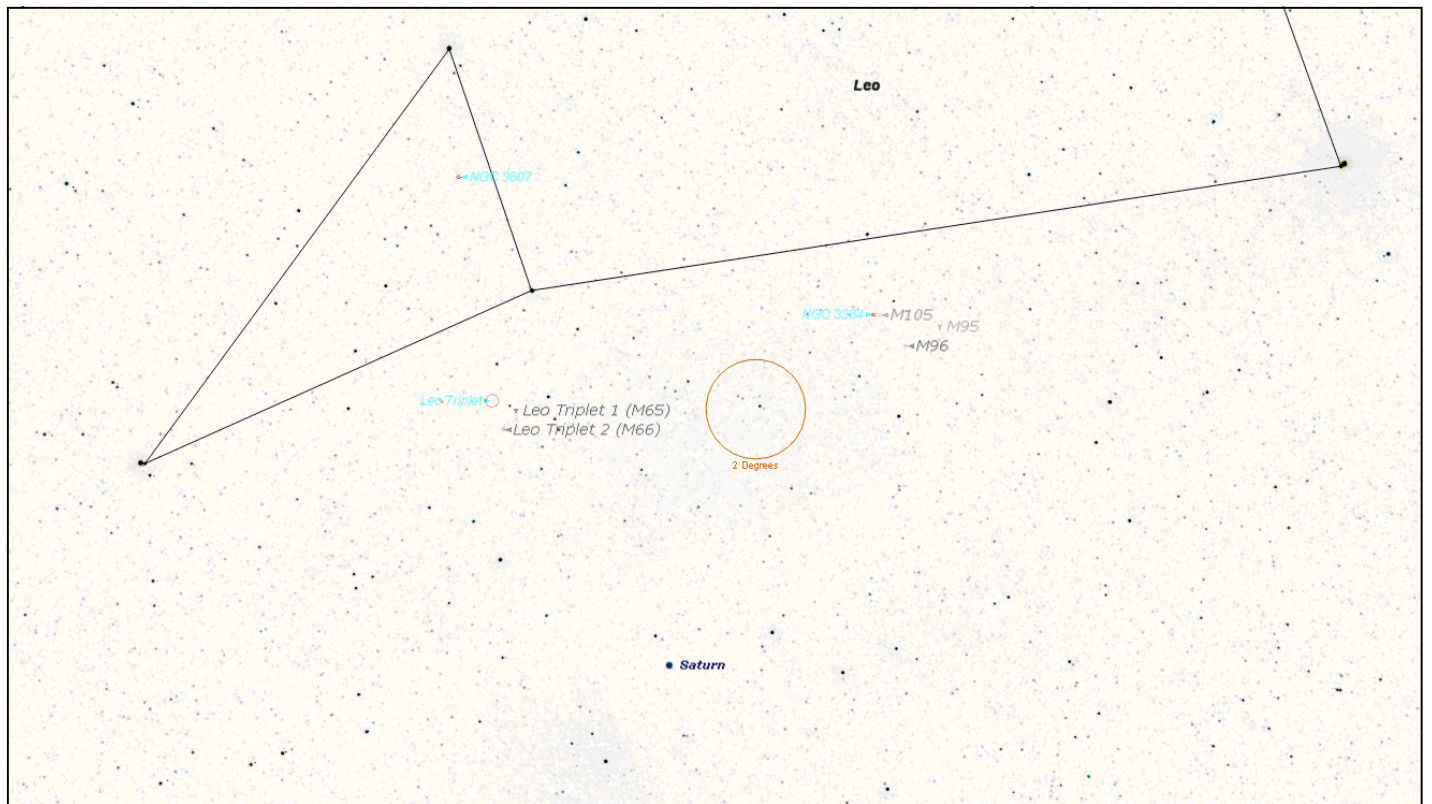
By Robert Duff

It was a bright sunny afternoon on Monday, March 16th, when I made a digital slide presentation at the March Break Day Camp, for 22 children (ages 7—11) along with 3 teachers and one older student, in the Resource Centre of White Oaks Public School in London. I brought the RASC London Centre's 2008 General Assembly photographic display along with my 20.3cm Meade Newtonian reflecting telescope on its Dobsonian mount. Dave McCarter was there and, after I had finished my presentation, which was punctuated by frequent questions from the group, we distributed copies of the book "Mary Lou's New Telescope." We then distributed "Star Finder" planispheres, helped the children assemble them with Scotch tape and showed them how to use them.

I encouraged the group to come out the Cronyn Observatory Open Houses on Tuesday, Wednesday and Thursday, March 17th—19th, celebrating the IYA, as well as Saturday, March 28th. Finally we distributed Galileo Moment cards. It was an enjoyable afternoon of astronomy for everybody.



The sky from London on March 31, 10:30pm. Notice Saturn is below Leo.



Closeup of Saturn's location. Note all the galaxies above Saturn. I included a 2 degree circle for distance comparison.