

# POLARIS



Royal Astronomical Society of Canada  
London Centre Newsletter  
April 2010

## Sundials: Their History and Form

Patrick Whelan

The sundial is the oldest known device for the measurement of time and the most ancient of scientific instruments. It is based on the fact that the shadow of an object will move from one side of the object to the other as the sun “moves” from east to west during the day.

### 2500-2000 BC

Babylonians and Egyptians build obelisks (slender, tapering four-sided monuments). Their moving shadows formed a kind of sundial, enabling citizens to divide the day into two parts by indicating noon. They also showed the year’s longest and shortest days when the shadow at noon was the longest or shortest of the year. Later, marks around the base of the monument would show further time divisions.

### 800 BC

More precise sundials are built in Egypt. The earliest known sundial still preserved is an Egyptian shadow clock of green schist dating from at least this period. It consists of a straight base with a raised crosspiece at one end. The base, on which is inscribed a scale of six time divisions, is placed in an east-west direction with the crosspiece at the east end in the morning and the west end in the afternoon. The shadow of the crosspiece on the base indicates the time.

### 290 BC

The first sundial is set up in Rome. It has been captured from the Samnites.

### 164 BC

The first sundial is constructed for the city of Rome designed by architect and engineer Marcus Vitruvius Pollio. He mentions many types of sundials, some of which are portable, in his great work *De architectura*.

### 150 AD

The Greeks introduce trigonometry into mathematics, thus supplying the tool for plotting hour lines with simple arithmetic calculations instead of the more cumbersome geometric constructions. This method will be exploited by the Arabs and later by European sundial makers.

### 1300 AD

The first all-mechanical clock is made. It is a large iron-

framed structure, driven by weights. The function of the first European clocks was not to indicate the time on a dial, but to drive dials that give astronomical indications, and to sound the hour. They are located in monasteries and public bell towers. The earliest surviving example, constructed in 1386, is in Salisbury Cathedral, England. Mechanical clocks utilize equal hours.

### 1500-1800 AD

The great age of the European sundial. Sundials with equal hours gradually come into use.

### 1635 AD

Galileo designs a clock using a pendulum as the timekeeping element.

### 1777 AD

French general Lafayette wants to express his respect and admiration for his ally and friend General George Washington during the American revolution. He chooses as his gift a silver Explorer sundial.

### 1700’s AD

Clocks and watches begin to replace sundials. They have the advantage of not requiring sunny skies. They are, however, often unreliable and depend upon sundials to set the true time.

### Early 1800’s AD

Mechanical clocks become accurate enough and inexpensive enough to displace sundials as the timepiece of choice.

Because of the earth’s rotation, a town 20 or 30 miles east or west has its clock set slightly differently. Your noon arrived somewhat before that of your western neighbor but sometime after that of your eastern neighbor. This made little difference because a resident might never travel to either of his neighboring towns.

### 1884 AD

Railroads are the preferred method of travel. Railroads demand schedules and schedules require “true” time. Along a 100 mile stretch of tracks there might be 6 towns with 6 different town clocks all different from the others. Passengers need to know when the train will arrive and

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## Moon Phases



April 21 2010



April 28 2010



May 6 2010



May 14 2010

### Article submissions

Or perhaps the title should be:  
Lack of article submissions.

Polaris is a newsletter for our members and by our members. I know how busy people can be. Believe me I know.

I just hope that some one person will submit an article each month. I have two regulars right now: Bob with his articles about the outreach the club does and John with his Sky Atlas Challenges.

Think about something you have done or read or thought about and share it with everyone else.

We will all be the better for it!

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Find the Polaris newsletters on the internet at: [www.patusratus.ca/Polaris](http://www.patusratus.ca/Polaris)

## LONDON RASC MONTHLY MEETINGS

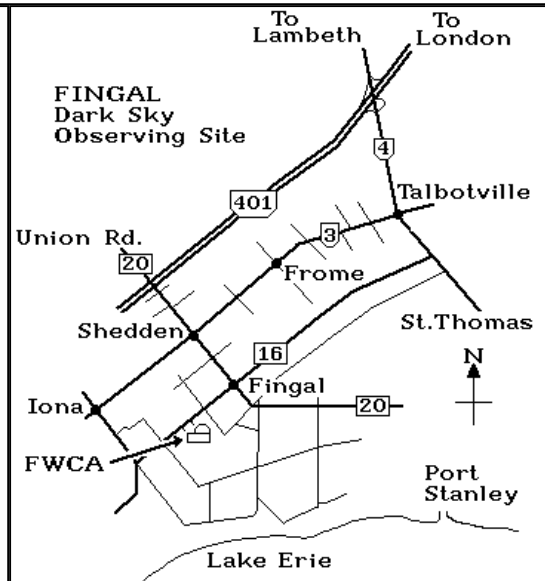
The London RASC group meets at Fanshawe College in London Ontario, September through July on the third Friday of the month at 19:00. We meet in room B1073.

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](http://www.rasc.ca/London)

Our dark sky observing site is at the **Fingal Wildlife Management Area**.



## Sky Events for late April and early May 2010

April 16 Mars 0.9° N of Beehive (M44)  
 April 16 Venus 4.0° S of Moon  
 April 17 Moon 0.5° S of Pleiades (M45)  
 April 18 Double shadow transit on Jupiter  
 April 19 Moon 0.2° N of M35  
 April 22 Double shadow transit on Jupiter  
 April 30 Antares 1.7° S of Moon  
 May 4 Pallas at opposition  
 May 16 Venus 0.1° S of Moon  
 May 16 Moon 0.04°N of M35  
 May 21 Venus 0.7° N of M35



**Venus is in the Western evening sky**  
**Mars is in the Eastern evening sky, gibbous and shrinking.**  
**Mars passes near the Beehive Cluster (M44) April 15 to 18**  
**Saturn is visible all night and is just past opposition**

### R.A.S.C. London Centre Library Books of the Month April 2010 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 April 2010 are as follows:

Burnham's Celestial Handbook: an Observer's Guide to the Universe Beyond the Solar System, by Robert Burnham. Revised and Enlarged Edition. c1978.

Volume One, Andromeda—Cetus.

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.

Universe on a T-shirt: the Quest for the Theory of Everything, by Dan Falk. c2002.

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

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](mailto:rduff@sympatico.ca)



### London Astrophotography Email List

London Centre has a new email forum for London Centre Astro photographers to communicate, share, and get assistance from other experienced members. As this list is about imaging, there is no restriction on file attachment size and therefore some **email messages may be very large**. But the images are worth it!

If you are interested in joining in, the URL is: <http://www.rasc.ca/mailman/listinfo/london-imagers>

### The Bob Duff Report

#### Exploring the Stars, Kerwood Sparks & Brownies, March 23rd, 2010

Clear skies, later turning cloudy, greeted 35 visitors (19 children and 16 adults) from the Kerwood Sparks and Brownies to the Cronyn Observatory for Exploring the Stars, Tuesday, March 23rd, 6:30 p.m. Graduate student Amanda Papadimos made her digital slide presentation, "Earth & Moon," followed by the activity, "Constellations."

Only a few brief glimpses of the Moon were possible with the 25.4cm dome refractor (52mm Erfle eyepiece, 84X) before it was obscured by clouds. (The dome motor also failed, but it was repaired the next day.) The visitors viewed the weather vane on the Engineering building roof and had a few brief glimpses of the Moon through the RASC London Centre's 25.4cm Dobsonian (17mm Nagler eyepiece, 67X) set up on the Observatory's roof patio.

Amanda ended the evening by having the children do a connect-the-dot activity and distributed Galileo Moment cards. Everybody enjoyed the event and left around 8:00 p.m.

#### Exploring the Stars, 1st Kerwood Guides, March 24th, 2010

Clear skies, with some hazy clouds, later in the evening, greeted 9 visitors (7 children and 2 adults) from the 1st Kerwood Guides to the Cronyn Observatory for Exploring the Stars, Wednesday, March 24th, 7:00 p.m. Alexander DeSouza made his digital slide presentation,

"Constellations," and this was followed by questions.

The visitors observed the Moon and Mars through the 25.4cm refractor in the dome (28mm Meade Super Wide Angle eyepiece, 156X) and later the Orion Nebula (M42), using the Orion Narrow Band Light Pollution Filter. They also viewed the Moon, Mars, M42 and Saturn in the 25.4cm Dobsonian, using the 17mm Nagler (67X) and 6mm Orthoscopic (190.5X) eyepieces.

Alexander gave one copy of "Mary Lou's New Telescope" to a little girl much younger than the Guides and distributed Galileo Moment cards. Everybody was gone by 8:50 p.m. after a very enjoyable evening under the stars.

#### Exploring the Stars, Katimavik, March 25th, 2010

Graduate student Emily McCullough reported that there were 12 young adults from the Katimavik group who came to the Cronyn Observatory for Exploring the Stars, Thursday, March 25th, 7:00 p.m. The topic of her digital slide presentation was "Misconceptions" but they also talked about planets, the solar system and galaxies. They were an interested group with many questions and ideas. Cloudy skies ruled out observing but Emily showed them the big 25.4cm refractor in the dome. Emily handed out Galileo Moment cards and they clearly enjoyed their visit. There were no RASC London Centre members at this event.

#### Exploring the Stars, Cronyn Observatory Open House, March 27th, 2010

Graduate student Emily McCullough made her digital slide  
*(Continued on page 5)*

### April Pocket Sky Atlas Challenges

April; and astronomers have visions of galaxy clusters dance in their heads. Now is the time to get your telescope rig sorted out for the next few months of viewing. Try to get your eyepieces, battery packs and other assorted bits assembled into a unified kit that is ready to go with observing with your telescope at a moment's notice. Don't forget the sky charts and lists of objects you want to see. April is also the biggest outreach month amateur astronomy has during the year. Make sure you share your love of the night sky with others. Sharing and explaining how you do astronomy, makes you think about what you are doing; in return, makes you better at what you do.

I've indexed the object to its star chart page.

#### Naked Eye:

Between April 16th and 25th, peaking on the 21st, 22nd is the Lyrids Meteor Shower. Look near Vega, page 63, toward the border of the Constellations Lyra and Hercules low in the east, north east

#### Small Scopes and binoculars:

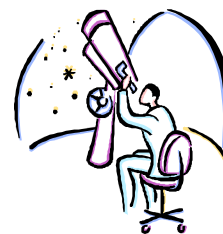
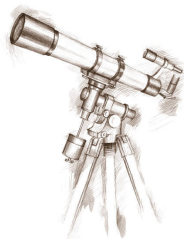
14 LMi and 15 LMi, page 33; M13 page 52

#### Larger Scopes:

UGC 10822 page 52; NGC 3193 and NGC 3190, Page 35.

#### Bonus objects:

NGC 4889 Pages 32, 43 ; NGC 3184 Page 33 ( good photo op!).



Happy hunting.  
John Kulczycki

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presentation, "Stellar Spectra," before 31 visitors to the Cronyn Observatory for the Exploring the Stars Open House, Saturday, March 27th, 7:00 p.m. More people arrived until by the end of the evening we had 52 visitors (adults and children).

I set up the 25.4cm Dobsonian (17mm Nagler eyepiece, 67X) on the Observatory roof patio and made ready the big 25.4cm refractor in the dome (28mm Meade Super Wide Angle eyepiece, 156X), directing it at the communications tower in south London. I made a brief presentation to the group before Emily arrived upstairs and gave her telescope tour. She showed them the communications tower and the nearly full Moon through hazy clouds.

Adam Priestap-Suttis and Cheryl Priestap arrived and Adam helped with the 25.4cm Dobsonian, showing visitors the Moon through hazy clouds. People kept arriving right up until closing time at 9:00 p.m.

### **Exploring the Stars, Space Society of London (SSoL), March 30th, 2010**

Clear skies greeted 4 members of the Space Society of London (SSoL) for Exploring the Stars at the Cronyn Observatory, Tuesday, March 30th, 7:00 p.m. Graduate student Amanda Papadimos made her digital slide presentation, "A Tour of our Neighbourhood."

Dave McCarter arrived around 7:40 p.m. and Mike Roffey around 8:00 p.m., bringing his 80mm alt-azimuth mounted Stellarvue apochromatic refractor. We began with the 28mm Meade Super Wide Angle (156X) eyepiece in the big 25.4cm dome refractor, but Dave swapped in the 12.5mm Orthoscopic eyepiece (351X) with the 1-1/2-inch adapter. Mars, with its distinct north polar cap, and Saturn, with nearly edge on rings, were splendid sights at 351X.

We viewed Mars, Saturn and the Orion Nebula (M42) in the RASC London Centre's 25.4cm Dobsonian (17mm Nagler, 67X and 6mm Orthoscopic, 190.5X, eyepieces) and Mike's 80mm refractor. Mike also showed them the double stars Castor and Algieba.

I gave a sky tour with my green laser pointer. The event ended around 9:25 p.m. after an enjoyable evening of stargazing and discussion.

### **Exploring the Stars, J. P. Robarts Home & School Association, March 31st, 2010**

It was a wonderfully clear night for a group of 24 visitors (11 adults and 13 children) from the J. P.

Robarts Home & School Association, who arrived for an evening of Exploring the Stars at the Cronyn Observatory, Wednesday, March 31st, 7:00 p.m. Graduate student Alexander DeSouza made his digital slide presentation, "Our Solar System," followed by the activity, "Kitchen Comet."

Paul and Charlene Kerans brought their 30.5cm Meade Lightbridge Truss-Tube Dobsonian and Mike Roffey his 127mm Maksutov on its Vixen alt-azimuth mount. I set up the London Centre's 25.4cm Dobsonian.

Alexander showed the visitors Mars in the 25.4cm dome refractor (28mm Meade Super Wide Angle eyepiece, 156X). They viewed Mars, Saturn and the Orion Nebula (M42) in the London Centre's 25.4cm Dobsonian (17mm Nagler, 67X, and 6mm Orthoscopic, 190.5X, eyepieces), Paul and Charlene's 30.5cm Dobsonian and Mike's 127mm Maksutov. We found a distinct improvement in contrast on M42 when we tried the Observatory's Orion Narrow Band Light Pollution Filter on both Dobsonians. Paul also showed people the galaxies M81 and M82 in his 30.5cm Dobsonian.

I gave a sky tour with my green laser pointer. Everybody enjoyed the event. The visitors were gone by 9:30 p.m. and we left the Observatory around 9:45 p.m.

### **Exploring the Stars, 1st Tillsonburg Guides, April 1st, 2010**

Clear skies greeted 17 visitors (children and adults) from the 1st Tillsonburg Guides at the Cronyn Observatory for an evening of Exploring the Stars, Thursday, April 1st, 7:00 p.m. Graduate student, Emily McCullough, made her digital slide presentation, "Constellations," and then gave everybody a tour of the big 25.4cm refractor in the dome. Dave McCarter arrived to help out.

As twilight deepened people were able to spot Mars and then Saturn in the sky and view them through the 25.4cm refractor. Emily also showed the visitors the Orion Nebula (M42) through the RASC London Centre's 25.4cm Dobsonian, set up on the roof patio. She also tried using the Orion Narrow Band Light Pollution filter to enhance the view of the Orion Nebula.

### **Exploring the Stars, 92nd London Sparks, April 7th, 2010**

Despite clouds and rain 22 visitors (12 children and 10 adults) arrived for an evening of Exploring the Stars at the Cronyn Observatory, Wednesday, April 7th, 7:00 p.m. Graduate student Alexander DeSouza made the digital slide presentation, "Earth & Moon." This was

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followed by the activity, "Rocket Races," in which children made their own rockets with plastic drink bottles, to be launched along a nylon chord with air expelled from a balloon. I distributed Galileo Moment cards provided by Alexander, who also distributed Canadian Space Agency bookmarks and gave a copy of "Mary Lou's New Telescope" as an award to one girl whose rocket flew the furthest. Alexander gave the group a tour of the 25.4cm refractor in the dome. Interested adults asked questions about astronomy and everybody had an enjoyable time. The group was gone by 8:30 p.m.

### **Exploring the Stars, 1st Belmont Scouts, April 8th, 2010**

Cloudy skies greeted 20 visitors (11 children and 9

adults) from the 1st Belmont Scouts for an evening of Exploring the Stars at the Cronyn Observatory, Thursday, April 8th, 7:00 p.m. Graduates student Amanda Papadimos made the digital slide presentation, "Our Solar System."

Amanda showed them the communications tower in south London through the big 25.4cm refractor (32mm Erfle eyepiece, 137X) in the dome. Through the 25.4cm Dobsonian (17mm Nagler eyepiece, 67X) set up on the roof patio I showed them the weather vane on the Engineering building to the south and a treetop to the east.

Afterwards, in the lecture room, Amanda distributed and helped assemble "Star Finder" planispheres, which I had brought. She also distributed Galileo Moment cards. The visitors had a good time despite the cloudy weather.

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*(Continued from page 1)*

depart and railroaders need to know when to send the next train in order to avoid accidents.

A conference is held and an agreement reached to divide the United States of America into four time zones, each 15 degrees wide – Eastern, Central, Mountain and Pacific, and all stations in a time zone would carry the same time. In fact, train time which is rigorously held to by the railroads becomes the time that cities and citizens set their clocks by. The train whistle becomes the signal for setting clocks.

### **Types of Sundials**

#### **Horizontal Dial:**

This is the type found commonly on pedestals in gardens. The dial plate is horizontal. The gnomon (which casts the shadow) makes an angle equal to the latitude of the location for which it was designed.

#### **Vertical Dial:**

This is the type found on the walls of churches and other buildings. Vertical sundials may be direct south dials if they face due south (in which case the gnomon will be at an angle equal to the co-latitude of the place, and the hour lines, if delineated for local time at the place, will be symmetrical about the vertical noon line).

If they do not face directly south, they are described as declining dials, and in this case the gnomon will be at a lesser angle than the co-latitude, and the hour lines will generally be grouped more tightly in the morning hours, for south-east decliners and, conversely, grouped in the afternoon hours for south-west decliners

Though much less common, there are dials with dial plates which are neither vertical nor horizontal. These are called reclining dials

#### **Equatorial dial:**

This type of sundial has its main surface parallel to the Earth's equator and the gnomon is perpendicular to it. The gnomon points to the Celestial north pole. Both sides of the dial must be marked since the shadow will be on one side in the summer and the other side in the winter.

#### **Pocket dial:**

This is a folding sundial with a string for the gnomon. It usually has a small compass inlaid into it so you can point it North.

#### **Polar Dial:**

This dial is set along the East-West direction and looks like a flat bar with the gnomon in the middle of it. The dial is inclined so it is parallel with the polar axis.

#### **Spherical Dial:**

This dial has a gnomon which is parallel to the polar axis (it points to the Celestial north pole) and the shadow is cast on a bar which has been bent into a semi-circular shape.

Here are some links to sundial sites:

<http://www.mysundial.ca/>

<http://www-istp.gsfc.nasa.gov/stargaze/Sundial.htm>

<http://sundials.org/> (North American Sundial Society)

<http://www.cadrans-solaires.org/> (great software called Shadows)

<http://www.sundials.co.uk/sunfair/>

<http://www.sundialsoc.org.uk/> (British Sundial Society)

To make an incredible array of paper sundials visit:

[http://www.mysundial.ca/sdu/sdu\\_sundial\\_kits.html](http://www.mysundial.ca/sdu/sdu_sundial_kits.html)

## Images of various types of sundials



**Horizontal Sundial**



**Vertical Sundial**



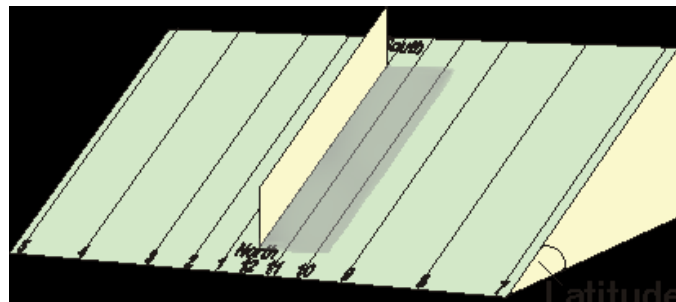
**Equatorial Sundial**



**Pocket Sundial**



**Equatorial Bow Sundial  
(the kind I have in my backyard)**



**Polar Sundial**