POLARIS

Royal Astronomical Society of Canada
London Centre Newsletter
February 2018

Useful Magnification Ranges for Visual Observing

Compiled By: Norman McCall

Anyone starting out in astronomy wonders where to start when selecting eyepieces for their new telescope. The primary mirror or objective lens gathers the light, but the eyepiece magnifies the image. Therefore, high-quality eyepieces are one of the two essentials required to achieve sharp and detailed views of your nighttime object. Poor optics at either end of the telescope results in less-than-optimal performance.

Eyepiece Formulas

Eyepiece formulae are used to compute the characteristics of your telescope and eyepiece are provided in the table below.

$$\text{Magnification} = \frac{\text{Objective focal length}}{\text{Eyepiece focal length}}$$

$$\text{f/number} = \frac{\text{Objective focal length}}{\text{Objective diameter}}$$

$$\text{True FOV} = \frac{\text{Eyepiece apparent FOV}}{\text{Magnification}}$$

$$\text{Exit pupil} = \frac{\text{Eyepiece focal length}}{\text{Objective f/number}}$$

$$\text{Dawes limit} = \frac{4.56 \text{ arcseconds}}{\text{Objective dia. (inches)}}$$

Focal Length

Selecting a set of eyepieces best for your telescope and budget requires understanding the merits of various eyepiece designs. The most important specification of any eyepiece is simply the focal length.

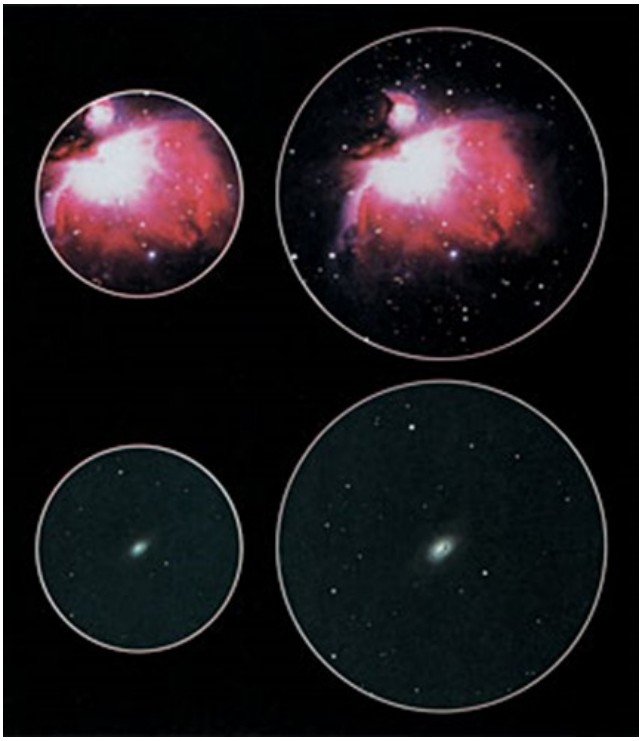
The focal length is marked on the outside of the eyepiece. A long focal length provides a low power or magnification while a shorter focal length provides a greater amount of magnification. The shorter the focal length the narrower the field of view (FOV) and the smaller the region of the sky that can be observed.

Apparent Field of View

How much sky is seen through the eyepiece depends on the magnification it provides and on its apparent field of vide (FOV). The apparent FOV depends on the optical design of the eyepiece. The apparent diameter of the circle (measured in degrees) observed through the eyepiece is the eyepiece's apparent FOV and is specified by the manufacturer.

Standard Orthoscopics and Plössls eyepieces have apparent fields of view of 45 to 55 degrees. Wide-angle eyepieces have 60 to 70-degree FOV's. Extreme wide-angle Naglers and Ultra Wides) have 82 to 100-degree fields of view. For example, take a 20mm Plössl with a 50-degree apparent FOV, on an 8-inch (2,032mm) f/10 Schmidt-Cassegrain has a magnification of 2032mm (focal length) divided by 20mm for 101.6 or approximately 100x. At that power, its actual field is about half a degree (50 degrees ÷ 100 ≈ 0.5 deg.) or just wide enough to see the moon.

In the image below compares eyepieces that have apparent fields of 50° (left) and 80° (right). The upper images show the difference between eyepieces that have the same



focal length and thus the same magnification on a given telescope. Here the larger apparent field translates into a larger true field showing more area of sky. The lower images cover the same field, but the right image is achieved by using a shorter-focal-length (higher-magnification) eyepiece with an 80° apparent field. In each case, the wider FOV presents a more impressive view.

Barrel Diameter

It may seem only a small increase to go from a 1¼-inch to a 2-inch eyepiece barrel, but the latter has an opening 70 percent larger in diameter and almost three times the area

(Continued on page 2)

of the former. This sets a limit on the true field (the amount of sky) visible with a telescope.

Take for example an 8-inch (2032mm) f/10 Schmidt-Cassegrain with a 2" diameter 55mm Plössl with a 50-degree FOV. In this configuration the magnification is 2032 ÷ 55 = 37 for a true FOV of 50 ÷ 37 or 1.3 degrees. But for a typical 1.25" eyepiece, the widest true FOV is about 0.8 degrees.

Eye Relief

Eye relief is the distance the eye must be from the eyepiece on order to view the whole FOV. With most eyepieces the higher the power the shorter (and less comfortable) the eye relief. Typical eyepieces have an eye relief of around 70% of their focal length. A wide angle 70 wide-angle or 82 degree ultra-wide eyepiece with 12 to 17mm of eye relief will delight any viewer.

Aesthetic Pursuit

Observational astronomy is an aesthetic pursuit for most amateurs. It seems presumptuous to try to quantify how high or low one can go, given the variety of instruments, subjects, atmospheric conditions, and eyesight that exists. I think, however, that two generalizations are valid:

- For the best low-power views, use the highest power that frames the subject.
- For the best high-power views, use the lowest power that reveals the detail you're looking for.

Low Power – 3.7 to 9.9x per inch of aperture

Low power is useful for finding objects and for observing ones of large angular size like open clusters, large faint nebulae, or some larger galaxies. For lunar work, it is generally somewhat on the low side, but can show the crescent moon with background starfields well. This is also the range where Nebula filters tend to perform the best.

Medium Power – 10x to 18.9x per inch of aperture

Medium power is useful for observing somewhat smaller deep-sky objects such as galaxies, some diffuse nebulae, smaller open clusters, and moderate to large planetary nebulae. Also useful in apertures 6 inches and larger for getting at least partial resolution on the brightest globular star clusters. Often used in moderate to large apertures for detecting very small galaxies which may be invisible at low powers and for revealing details in some galaxies like dark lanes, mottling, and star-like nuclei. Medium power is very useful for wide area views of the moon, or for showing the moon systems and some of the larger features of the planets. A recommended guideline is 10x to 18.9x per inch of aperture (i.e. 2.5mm to 1.3mm of exit pupil).

High Power – 19x to 31.9x per inch of aperture

A very useful power range for observing fine planetary and lunar detail. This is the range where the full theoretical resolving power of the telescope is becoming visible. Also useful for getting better star resolution in tight globular clusters or for viewing detail in the smaller planetary nebulae, as well as resolving tight double stars. This power range is sometimes compromised in apertures larger than 5 inches by seeing effects (ie: disturbances in the Earth's atmosphere which can blur fine detail).

Very High Power – 32x to 46.9x per inch of aperture

Very high power is useful for study of certain specific planetary details and resolving double stars near or just above the resolution limit of the instrument. Also useful for resolving the cores of some very tight globular clusters or for detecting the finer detail and faint central stars in the smaller planetary nebulae. Quite useful for telescope collimation tests or rough star-testing.

This power range is not as frequently usable with larger apertures due to seeing disturbances. For planetary viewing, eye defects like motes and floaters (along with the somewhat lower overall light level), begin to become visible and slightly annoying in the upper half of this range.

Extreme Power – 47x to 75x per inch

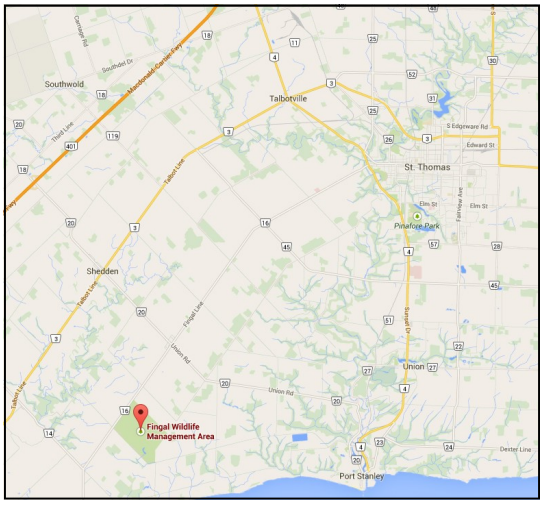
Extreme power is mainly used for resolution of double stars at the resolution limit of the instrument, or for detecting elongation of unresolved doubles. Powers up to 60x per inch are sometimes usable in rather small instruments for making gross planetary detail easier for beginners to see (ie: Jupiter's main belts or the Cassini Division in Saturn's rings). This power range is not often used in apertures above 6 inches due to seeing limitations, and requires very good optical quality in the instrument. Even when conditions are good, lunar and planetary views using this power range can sometimes seem less pleasing overall than at somewhat lower powers due to the lower light intensity and increasing interference from eye defects like floaters. However, this range can be somewhat useful for certain specific targets or details which require extreme scale. Examples include (for large apertures) seeing Encke's Division in Saturn's rings, the central star in M57, detail in some brighter planetary nebulae, or for resolving a few small specific lunar details.

Summary

So which eyepieces to get? Firstly, a good rule of thumb is to know the maximum useful magnification for your telescope. You can figure that out by multiplying your scope's aperture by 50. (ex. 8in. x 50=400x). That will give you the highest useful magnification for your scope, viewing conditions not withstanding. Then for eyepieces, a good recommendation is one in the low, medium, and high-power ranges to start out with. Or alternately, two eyepieces and a 2x or 2.5x Barlow that ends up covering the low, medium, high and very high-power ranges.

Clear skies to you.

Fingal Dark Sky Observing Site



Sky Events for Late February and early March

Feb. 17 Mercury in superior conjunction
Feb. 23 First quarter, Aldebaran 0.7° S of Moon, occultation
Feb. 25 Algol at minimum
Mar. 1 Regulus 0.9° S of Moon, occultation
Mar. 2 Full Moon
Mar. 5 Zodiacal light visible in N lat. In W after twilight for next 2 weeks
Mar. 5 Mercury 1.4° N of Venus
Mar. 9 Last quarter

Planets

Mercury: Emerges in the evening sky early in the month
Venus: Gradually emerging into the evening sky where it will enjoy fine apparition right into the autumn
Mars: Passes from Scorpius int Sagittarius and gradually closes the gap on Saturn for the remainder of the month
Jupiter: Reaches its first stationary point on the 9th and begins its retrograde motion among stars of Libra
Saturn: Can be seen low in the SE in morning sky.
Uranus: Can be found in the early evening sky with increasing difficulty as it approaches its April conjunction
Neptune: Remains too close to the Sun to be seen all month

R.A.S.C. London Centre Library — Books of the Month, February 2018

By Robert Duff

As always, these "Books of the Month" are available for loan to members, to be returned at the following monthly meeting. The books for February 2018 are as follows:

- *In Search of Time: Journeys Along a Curious Dimension,* by Dan Falk. c2008.
- *The Science of Shakespeare: A New Look at the Playwright's Universe,* by Dan Falk. C2014
- *Looking Up: a History of the Royal Astronomical Society of Canada,* by R. Peter Broughton. c1994.

For a complete listing of our RASC London Centre Library collection please click on the Library menu at the top of the RASC London Centre main Web page: http://rasclondon.ca/

If there is a particular book or video you wish to borrow, contact Bob at 519-439-7504 or by e-mail at **rduff@sympatico.ca**

Cronyn Observatory Public Nights, Exploring the Stars & Special Events, January 9th—February 6th, 2018

By Robert Duff

Exploring the Stars, École secondaire Gabriel-Dumont, January 9th, 2018

A partly cloudy sky greeted 16 visitors (15 students and 1 teacher) from École secondaire Gabriel-Dumont, for Exploring the Stars at Western University's Cronyn Observatory, Tuesday, January 9th, 2018, 5:15—6:45 p.m. Graduate student Jeff Vankerkhove presented the digital slide presentation *"Galaxies"* and planned to follow this with the activity *"Telescope Kits."*

This Exploring the Stars event was ended early, when RASC London Centre member Bob Duff—who arrived shortly after Jeff began his slide presentation—found that a frozen water pipe had broken in the darkroom, and was beginning to flood the observatory dome floor!

Jeff was well into his slide presentation when Bob informed him and the teacher and students, that there was a flood in the dome. The slide presentation was promptly ended and the *"Telescope Kits"* activity was cancelled. Jeff immediately contacted campus Facilities Management and Professor Jan Cami on his cell phone. The water soon poured from the dome down the stairs into the basement TA storeroom, bathroom and heating plant room.

The school teacher also noticed water pouring from the ceiling into the main floor bathroom beside the lecture room, from the dark room upstairs. The students and teacher departed around 6:30 p.m. to attend a lecture in the Physics and Astronomy Building by Professor Robert Cockcroft.

A campus police officer arrived and Facilities Management staff members came over and soon began wiping up the water in the dome and downstairs with squeegees and pumps. The basement heating room (connected to the campus steam plant) was flooded along with the bathroom and TA supplies storeroom. Jeff and Bob cleared out the telescope tripods and 2 telescope carrying cases from the darkroom floor, moving the tripods eventually downstairs into the *"1940s Period Room."* Some boxes from the basement TA storeroom were also removed to the *"Black Room."* This included the box containing the flour and chocolate powder for the *"Crater Experiment,"* which had become wet, with the contents being removed to a dry box.

Cronyn Observatory Weekday Public Night, Monday, January 15th, 2018

A cloudy sky with some light snow greeted 11 visitors (including 3 children) to Western University's Cronyn Observatory Weekday Public Night, Monday, January 15th, 2018, 7:00 p.m. Since there was no slide presentation, graduate student Amanda DeSouza greeted visitors and directed them upstairs into the dome. She showed one group the *"Spectroscopy Demo,"* downstairs in the *"Black Room."* Amanda counted 11 visitors for the evening.

RASC London Centre was represented by Everett Clark, later joined by Bob Duff. Since snowy weather ruled out opening the dome, Everett set up the observatory's 8-inch (20.3cm) Meade Schmidt-Cassegrain (26mm Plossl eyepiece, 77X) inside the dome so as to view the TV screen in the Western Sports & Recreation Center windows, through the door to

the observation deck. Everett gave interested visitors 3 *"Star Finder"* planispheres and 3 *"Moon Gazers' Guide"* cards.

Downstairs in the *"Black Room"* Amanda did the *"Spectroscopy Demo,"* for 3 visitors, who put on the *diffraction grating* glasses to view the spectra of 4 gas discharge lamps set out on the table, including: hydrogen, helium, neon and mercury. Amanda gave one of the observatory's solar eclipse glasses to an interested visitor. The observatory was closed down around 8:32 p.m. after an interesting evening for the visitors, learning about astronomy, despite the unfavourable weather.

Exploring the Stars, London Stargazers, January 16th, 2018

A cloudy sky with some light snow greeted 5 visitors from the London Stargazers, for Exploring the Stars at Western University's Cronyn Observatory, Tuesday, January 16th, 2018, 7:00 p.m. Graduate student Viraja Khatu presented the digital slide presentation *"Galaxies"* and fielded questions. The visitors were then invited downstairs into the *"Black Room,"* where Viraja did the *"Transit Demonstration"* activity, showing them the *"Transit Demo"* model—demonstrating the transit detection method for finding extra-solar planets.

RASC London Centre was represented by Everett Clark, later joined by Bob Duff, who arrived around 8:00 p.m. The visitors were given a tour of the big 25.4cm refractor in the dome, which remained closed due to the snowy conditions. The London Centre's 25.4cm Dobsonian was hauled out of the storeroom for demonstration. Everett distributed 4 *"Star Finder"* planispheres to the visitors. The visitors were gone by around 8:35 p.m. after an interesting and enjoyable evening learning about astronomy and telescopes, despite the cloudy snowy weather.

Exploring the Stars, London 88th Guide Unit, January 22nd, 2018

A cloudy sky with rain greeted 26 visitors (21 children and 5 adults) from the London 88th Guide Unit for Exploring the Stars at Western University's Cronyn Observatory, Monday, January 22nd, 2018, 6:00 p.m. Graduate student Daniel Hatfield presented the digital slide presentation *"The Scout / Guide Astronomy Badge"* and fielded questions. Dan followed this with the activity *"Kitchen Comet,"* making a comet from dry ice and other materials.

This was followed by a tour of the dome and Dan demonstrated the big 25.4cm refractor. Since rainy weather ruled out opening the dome, RASC London Centre member Bob Duff gave a talk on the history of the Cronyn Observatory and some of the technical aspects of the big 25.4cm refractor, using the 32mm Erfle eyepiece (137X) for demonstration. Bob also explained the Schmidt Camera and Cassegrain Reflector telescope piggy-backed on the 25.4cm refractor. He also explained the 2 clocks on the east wall of the observatory and the difference between Standard and Sidereal Time.

Dan then brought everybody downstairs into the *"Black Room"* where he did the *"Spectroscopy Demo,"* with the visitors putting on the *diffraction grating* glasses to view the spectra of 4 gas discharge lamps set out on the table, including: hydrogen, helium, neon and mercury. The visitors were gone by around 8:05 p.m. after an interesting and enjoyable evening learning about astronomy, comets, telescopes and spectroscopy, despite the unfavourable weather.

Exploring the Stars, 67th London Spark Unit, January 23rd, 2018

A cloudy sky with a light drizzle or rain greeted 20 visitors (10 children and 10 adults / leaders) from the 67th London Spark Unit for Exploring the Stars at Western University's Cronyn Observatory, Tuesday, January 23rd, 2018, 6:30 p.m. Graduate student Jeff Vankerkhove presented the digital slide presentation *"The Scout / Guide Astronomy Badge"* and fielded questions.

Jeff followed this by presenting the *"Make Your Own Constellation"*—part of the activity *"Make Your Own Constellation / Constellation Detective"*—but leaving out the *"Constellation Detective."* He showed the slide *"How Many Constellations?"* with the children drawing their own constellations by connecting the dots on a given pattern of stars on white transparency sheets with magic markers, and making up their own constellation stories.

RASC London Centre was represented by Bob Duff. Since damp rainy weather ruled out opening the dome, Bob set up the London Centre's 25.4cm Dobsonian (17mm Nagler eyepiece, 66X) so as to view the wind turbine on the Engineering building from inside the door to the observation deck. He also set up the observatory's Meade 8-inch (20.3cm) Schmidt-Cassegrain (26mm Plossl eyepiece, 77X) so as to view the TV screen in the Western Sports & Recreation Center windows, through the door to the observation deck.

When everybody arrived upstairs in the dome, Jeff explained some of the technical features of the big 25.4cm refractor. Bob gave a talk on the history of the observatory and technical aspects of the big 25.4cm refractor, using the 32mm Erfle eyepiece (137X) for demonstration. Bob also explained the Schmidt Camera and Cassegrain Reflector telescope piggy-backed on the 25.4cm refractor. Jeff demonstrated how the dome could be rotated and Bob explained the 2 clocks on the east wall of the observatory and the difference between Standard and Sidereal Time.

Bob showed them the 25.4cm Dobsonian and 20.3cm Schmidt-Cassegrain and explained the difference between a reflector and refractor telescope. The visitors were then invited to view though the telescopes, with Jeff supervising as they viewed the TV screen in the Western Sports & Recreation Center windows through the 20.3cm Schmidt-Cassegrain and Bob showing them the wind turbine on the Engineering building through the 25.4cm Dobsonian. The visitors were gone by around 7:45 p.m., after expressing their appreciation for a very interesting and enjoyable evening learning about astronomy, constellations and telescopes.

Cronyn Observatory Public Night, Saturday, January 27th, 2018

A partly cloudy, later clearing sky greeted an estimated 80 visitors to the Western University's Cronyn Observatory Public Night, Saturday, January 27th, 2018, 7:00 p.m. Graduate student Jeff Vankerkhove made 2 presentations of his digital slide presentation *"Why can't I see any stars tonight?! A look at Earth's atmosphere and UWO's role in trying to understand it."* There were 42 visitors in the lecture room for Jeff's first slide presentation and 28 in the dome or just arriving, as counted by RASC London Centre member Bob Duff at 7:30 p.m. There were just 5 people for Jeff's second presentation. In all, there were an estimated 80 visitors for the evening.

Graduate student Viraja Khatu operated the big 25.4cm refractor in the dome showing visitors the 3-days-past-first quarter gibbous Moon, using the 32mm Erfle eyepiece (137X) and later swapping in the Meade 28mm Super Wide Angle eyepiece (157X) for a better view. RASC London Centre was represented by Everett Clark, Henry Leparskas and Bob Duff, later joined by Dale Armstrong, Mark Tovey and Edith Tovey. Everett set up the observatory's 8-inch (20.3cm) Meade Schmidt-Cassegrain (20mm Plossl eyepiece, 100X) inside the dome, and Bob supervised as visitors viewed the TV screen in the Western Sports & Recreation Center windows, through the door to the observation deck. As the sky cleared Bob and Dale moved the 20.3cm Schmidt-Cassegrain out onto the observation deck and Everett also set up the RASC London Centre's 25.4cm Dobsonian. Dale operated the 20.3cm Schmidt-Cassegrain

showing visitors the Orion Nebula (M42), using the 26mm Plossl eyepiece (77X). Bob operated the 25.4cm Dobsonian, installing the 17mm Nagler eyepiece (66X) and showing visitors Orion Nebula (M42) and the Pleiades star cluster (M45).

Downstairs in the *"Black Room"* Henry Leparskas gave demonstrations of the *"Transit Demo"* model—showing how the transit detection method worked for finding extra-solar planets. Mark Tovey gave tours of the historic *"1940s Period Room,"* a recreation of Dr. H. R. Kingston's 1940 office, with his brass refractor and the *Sotellunium*—a mechanical eclipse demonstration model built by W. G. Colgrove—on display. Mark also showed them the *"1967 Period Room,"* recreating the early control room of the Elginfield Observatory to celebrate the 150th anniversary of Confederation—Canada 150. Henry also gave 2 tours to groups through the *"1940s Period Room,"* while Mark was in the *"1967 Period Room"* with other groups. Both "*Period Rooms"* were designed by Mark Tovey.

Bob and Everett talked to one inquiring visitor about choosing a telescope and Everett gave out 12 *"Star Finder"* planispheres to children. People asked many good questions. The visitors were gone by around 9:00 p.m., after an enjoyable evening learning about astronomy and observing through telescopes.

Exploring the Stars, King's University College Foundations and King's Scholar Programs, January 31st, 2018

A cloudy, later clearing, slightly hazy sky greeted 25 visitors (students and a faculty member) from the King's University College Foundations and King's Scholar programs, for Exploring the Stars at Western University's Cronyn Observatory, Wednesday, January 31st, 2018, 7:00 p.m. Graduate student Amanda DeSouza presented the digital slide presentation *"The Earth Moon System"* and fielded questions. The visitors then divided into 2 groups with Amanda taking one group downstairs into the *"Black Room"* for the *"Transit Demonstration"* activity and the *"Spectroscopy Demo."* The other group went with RASC London Centre member Bob Duff upstairs into the dome. The 2 groups later exchanged places between the *"Black Room"* and the dome.

When the first group arrived upstairs in the dome, Bob began with a talk on the history of the observatory and technical aspects of the big 25.4cm refractor. The door to the observation deck was open and one of the visitors called everybody's attention to the full Moon visible in the hazy but clearing sky, and asked if it could be observed through the telescope. Bob directed the big 25.4cm refractor towards the Moon in the eastern sky, installing the 17mm Nagler eyepiece (258X). Bob later swapped in the 52mm Erfle eyepiece (84X) into the 25.4cm refractor, for a sharper view of the Moon in the hazy sky. The visitors were delighted to view the Moon through the telescope and Bob continued with his talk, explaining the Schmidt Camera and Cassegrain Reflector telescope piggy-backed on the 25.4cm refractor as well as the 2 clocks on the east wall of the observatory and the difference between Standard and Sidereal Time.

Bob gave his talk to the second group when they arrived in the dome and the first group had gone downstairs into the *"Black Room."* He hauled out the London Centre's 25.4cm Dobsonian, setting it up on the observation deck and installing the 18mm Radian eyepiece (62X). Bob explained the difference between a reflector and refractor telescope and the visitors from the first group came back upstairs to enjoy the view of the Moon through the 25.4cm Dobsonian. Bob also showed one visitor, Sirius and Betelgeuse through the 25.4cm Dobsonian. At the request of a visitor, Bob reinstalled the 17mm Nagler eyepiece in the 25.4cm refractor for a higher magnification (258X) view of the Moon, which was now higher in the sky and looked somewhat sharper, despite the hazy clouds.

Downstairs in the *"Black Room"* Amanda did the *"Transit Demonstration"* activity twice, once for each group, showing them the *"Transit Demo"* model—demonstrating the transit detection method for finding extra-solar planets. She also did the *"Spectroscopy Demo,"* twice, once for each group, with the visitors putting on the *diffraction grating* glasses to view the spectra of 4 gas discharge lamps set out on the table, including: hydrogen, helium, neon and mercury.

Bob gave a copy of the RASC London Centre's newsletter, *Polaris* (December 2017) to the King's University College faculty member leading the group. The visitors were gone just before 9:00 p.m. after expressing their thanks for a very interesting and enjoyable evening of astronomy.

Exploring the Stars, 2nd Lambeth Girl Guides and 1st Lambeth Pathfinders and Rangers, February 6th, 2018

A partly cloudy, hazy sky and cold weather greeted 25 visitors (including children and adults / leaders) from the 2nd Lambeth Girl Guides and 1st Lambeth Pathfinders and Rangers, for Exploring the Stars at Western University's Cronyn Observatory, Tuesday, February 6th, 2018, 6:30 p.m. Graduate student Amanda DeSouza presented the digital slide presentation *"The Scout / Guide Astronomy Badge"* and fielded questions. Amanda then took the group downstairs into the *"Black Room"* for the *"Spectroscopy Demo,"* with the visitors putting on the *diffraction grating* glasses to view the spectra of 4 gas discharge lamps set out on the table, including: hydrogen, helium, neon and mercury.

RASC London Centre was represented by Everett Clark, Henry Leparskas and Bob Duff. Everett and Henry directed the big 25.4cm refractor (17mm Nagler eyepiece, 258X) towards the double star Gamma Andromedae (also known as Almach). Henry, Everett and Bob viewed an ISS pass at 7:10—7:13 p.m., travelling northwest—north northwest, reaching a maximum altitude of 25 degrees above the north northwest horizon (19:10:08—maximum altitude 25 degrees @19:12:56—19:13:07). When the visitors arrived upstairs in the dome Bob gave a brief talk on the history of the Cronyn Observatory and some of the technical aspects of the big 25.4cm refractor. Everybody enjoyed the view through the 25.4cm refractor, with the Gamma Andromedae primary star appearing golden-yellow, accompanied by the fainter blue secondary. Everybody went out onto the observation deck to view 2 bright Iridium flares both in the same location 40 degrees above the south southeast horizon, just 23 seconds apart at 7:37 p.m. (19:37:12 and 19:37:35 respectively).*

Everett and Henry later directed the big 25.4cm refractor towards the Orion Nebula (M42), swapping in the Meade 28mm Super Wide Angle eyepiece (157X) to give the visitors a better view. Towards the end of the evening and on request, Amanda made a brief presentation on black holes—using images from the Internet—for the older children who needed it for their astronomy badge. The visitors were gone by around 8:00 p.m. after and enjoyable evening of astronomy.

Information concerning "ISS – Visible Passes" and "Iridium Flares" was found using the coordinates for London, Ontario, on the "Heavens Above" Web site: **http://www.heavens-above.com/*