

# POLARIS



## Royal Astronomical Society of Canada London Centre Newsletter April 2018

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### Steven Hawking—A Brief Moment on Time *Compiled By: Norman McCall*

On March 14<sup>th</sup>, 2018 the world of science lost a special person in Stephen Hawking at the age of 76. Having been diagnosed with ALS at the age of 21 and while being given only 2-year to live, his disease progressed slowly and despite becoming slowly constricted to a life of the mind through his indomitable energy he beat the odds and through the boundless power of the human spirit he was an inspiration to millions around the world. When asked about his physical condition he stated: "It is a waste of time to be angry about my disability. One must get on with life and I haven't done badly. People won't have time for you if you are always angry or complaining."

Neil Turok the Director of the Perimeter Institute in Waterloo worked with Hawking at the University of Cambridge, where they became close collaborators and friends. Turok stated "Stephen's life was heroic, in so many ways. He was a brilliant visionary in theoretical physics, setting an incredibly bold agenda for the field."

"Uncompromising in his scientific honesty and his search for the truth, always willing to listen and to explore new ideas. He combined this with extraordinary personal warmth, an acute sense of humour, a deep love for people and for sharing good times together. His incredible power and determination to overcome the constraints of his condition was the ultimate example of mind over matter.

Stephen Hawking's genius and indomitable energy were an inspiration to the entire scientific research community and to millions around the world. Despite decades of declining mobility and the loss of his voice due to ALS also known as motor neuron disease, Hawking inspired millions through his intellectual explorations of the universe and his popularization of modern cosmology.

His scientific contributions are vast: from his theoretical prediction that black holes emit radiation (now known as Hawking Radiation), to sharpening our understanding of the beginning of the universe, to his work toward a unification of general relativity and quantum theory – the two pillars of modern physics.

The Perimeter Institute was fortunate to host Hawking for two research terms, during which he collaborated with Perimeter researchers and students and shared his discoveries in a widely viewed televised public lecture. See: <https://www.youtube.com/watch?v=2jW6wdG0XPU>

In 2011, Perimeter had the great honour of opening the Steven Hawking Centre – the only building in the world to which Hawking lent his name. At the opening of the cen-

tre, Hawking said "the importance of special places and special times, where magical progress can happen, cannot be overstated. I am hoping, and expecting, great things will happen here."

#### Research on the Universe and Black Holes

In 1974, Hawking's research turned him into a celebrity within the scientific world when he showed that black holes aren't the information vacuums that scientists had thought they were. In simple terms, Hawking demonstrated that matter, in the form of radiation, can escape the gravitational force of a collapsed star. Another young cosmologist, Roger Penrose, had earlier discovered groundbreaking findings about the fate of stars and the creation of black holes, which tapped into Hawking's own fascination with how the universe began. The pair then began working together to expand upon Penrose's earlier work, setting Hawking on a career course marked by awards, notoriety and distinguished titles that reshaped the way the world thinks about black holes and the universe.

When Hawking's radiation theory was born, the announcement sent shock waves of excitement through the scientific world. Hawking was named a fellow of the Royal Society at the age of 32, and later earned the prestigious Albert Einstein Award, among other honors. He also earned teaching stints at Caltech in Pasadena, California, where he served as visiting professor, and at Gonville and Caius College in Cambridge.

Some of the physicist's greatest hits – from singularities in gravitational collapse to a quantum theory of gravity are listed in the following sections.

#### 1970 Singularities in Gravitational Collapse

Physicists working on Einstein's theory of gravity noticed that it allowed for singularities – points where spacetime appeared to be infinitely curved. But it was unclear whether singularities were real or not. Roger Penrose at Birkbeck College in London proved that singularities would indeed form in black holes. Later, Penrose and Hawking applied the same idea to the whole universe and showed that Einstein's theory predicted a singularity in our distant past. It was the big bang.

#### 1971-72 Black Hole Mechanics

Black holes have their own set of laws that mirror the more familiar laws of thermodynamics. Hawking came up with the second law, which states that the total surface

*(Continued on page 2)*

area of a black hole will never get smaller, at least so far as classical (as opposed to quantum) physics is concerned. Also known as the Hawking area theorem, it created a puzzle for physicists. The law implied that black holes were hot, a contradiction of classical physics that said black holes could not radiate heat. In separate work, Hawking worked on the "no hair" theorem of black holes, which states that black holes can be characterised by three numbers – their mass, angular momentum and charge. The hair in question is other information that vanishes when it falls into the black hole.

**1974-75 How Black Holes Can Vanish**

Nothing can escape a black hole, or so physicists once thought. Hawking drew on quantum theory to show that black holes should emit heat and eventually vanish. The process is slow for normal black holes. It would take longer than the age of the universe for a black hole with the same mass as our sun to evaporate. But smaller black holes evaporate faster, and near the end of their lives release heat at a spectacular rate. In the last tenth of a second, a black hole could explode with the energy of a million one megaton hydrogen bombs.

**1982 How Galaxies Might Arise**

A popular theory in cosmology holds that the fledgling universe went through a period of rapid inflation soon after the big bang. Hawking was one of the first to show how quantum fluctuations – minuscule variations in the distribution of matter – during inflation might give rise to the spread of galaxies in the universe. What started as a tiny difference grew into the cosmic structure we see, as gravity made matter clump together. Recent maps of the heavens that pick up the faint afterglow of the big bang reveal the kinds of variations Hawking worked with.

**1983 Wave Function of the Universe**

Hawking has spent much of his time trying to develop a quantum theory of gravity. He started out applying his idea of Euclidean quantum gravity to black holes, but in 1983 teamed up with Jim Hartle at Chicago University. Together they proposed a "wave function of the universe" that, in theory, could be used to calculate the properties of the universe we see around us.

**View on God & Creation**

In September 2010, Hawking spoke against the idea that God could have created the universe in his book *The Grand Design*. Hawking previously argued that belief in a creator could be compatible with modern scientific theories. In this work, however, he concluded that the Big Bang was the inevitable consequence of the laws of physics and nothing more. "Because there is a law such as gravity, the universe can and will create itself from nothing," Hawking said. "Spontaneous creation is the reason there is something rather than nothing, why the universe exists, why we exist."

**Beginning of the Universe**

In a March 2018 interview on Neil deGrasse Tyson's Star Talk, Hawking addressed the topic of "what was around before the Big Bang" by stating there was nothing around. He said by applying a Euclidean approach to quantum gravity, which replaces real time with imaginary time, the history of the universe becomes like a four-dimensional curved surface, with no boundary. He suggested picturing this reality by thinking of imaginary time and real time as beginning at the Earth's South Pole, a point of space-time where the normal laws of physics hold; as there is nothing "south" of the South Pole, there was also nothing before the Big Bang.

**Stephen Hawking's Books**

Over the years, Stephen Hawking wrote or co-wrote a total of 15

books. A few of the most noteworthy include:

- A Brief History of Time
- The Universe in a Nutshell
- A Briefer History of Time
- The Grand Design

**TV and Film Appearances**

If there is such a thing as a rock-star scientist, Stephen Hawking embodied it. His forays into popular culture included guest appearances on *The Simpsons*, *Star Trek: The Next Generation*, a comedy spoof with comedian Jim Carrey on *Late Night with Conan O'Brien*, and even a recorded voice-over on the Pink Floyd song "Keep Talking." In 1992, Oscar-winning filmmaker Errol Morris released a documentary about Hawking's life, aptly titled *A Brief History of Time*. Other TV and movie appearances include:

**'The Big Bang Theory'**

In 2012, Hawking showed off his humorous side on American television, making a guest appearance on *The Big Bang Theory*. Playing himself on this popular comedy about a group of young, geeky scientists, Hawking brings the theoretical physicist Sheldon Cooper (Jim Parsons) back to Earth after finding an error in his work. Hawking earned kudos for this lighthearted effort.

**'The Theory of Everything'**

In November of 2014, a film about the life of Stephen Hawking and Jane Wilde was released. *The Theory of Everything* stars Eddie Redmayne as Hawking and encompasses his early life and school days, his courtship and marriage to Wilde, the progression of his crippling disease and his scientific triumphs.

**'Genius'**

In May 2016, Hawking hosted and narrated *Genius*, a six-part television series which enlists volunteers to tackle scientific questions that have been asked throughout history. In a statement regarding his series, Hawking said *Genius* is "a project that furthers my lifelong aim to bring science to the public. It's a fun show that tries to find out if ordinary people are smart enough to think like the greatest minds who ever lived. Being an optimist, I think they will."

**Death**

On March 14, 2018, Hawking finally succumbed to the disease that was supposed to have killed him more than 50 years earlier. The news touched many in his field and beyond. Fellow theoretical physicist and author Lawrence Krauss tweeted: "A star just went out in the cosmos. We have lost an amazing human being. Stephen Hawking fought and tamed the cosmos bravely for 76 years and taught us all something important about what it truly means to celebrate about being human."

**Reference Sources**

- <https://www.biography.com/people/stephen-hawking-9331710>
- <https://perimeterinstitute.ca/news/perimeter-institute-mourns-passing-friend-and-colleague-stephen-hawking>

**London Centre 2018 Messier Marathon Reports**

Please read the two excellent Reports submitted by Dale Armstrong and Peter Jedicke. They are listed on the RASC London (member) Forums under Astronomy >> Observing.

## Sky Events for Late April and Early May

Apr. 22 First Quarter  
 Apr. 23 Moon 1.9° S of Beehive M44  
 Apr. 24 Regulus 1.2° S of Moon  
 Apr. 29 Mercury greatest elongation W (27°)  
 May 4 Saturn 1.7° S of Moon  
 May 8 Last quarter  
 May 9 Jupiter at opposition  
 May 15 New Moon



### Planets

Mercury: Brightens throughout May and reaches mag. 0.0 on Mat 12th  
 Venus: Continues to climb topping out at 25° late in the month  
 Mars: Doubles in brightness over the course of the month increasing from mag. -0.4 to -1.2  
 Jupiter: Reaches opposition on the 9th at mag. -2.5  
 Saturn: Its subtle retrograde (westerly) motion gains momentum throughout the month  
 Uranus: Returns to the dawn sky in mid-May  
 Neptune: In the morning sky among the late-rising stars of Aquarius

### R.A.S.C. London Centre Library — Books of the Month, March 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 April 2018 are as follows:

- *Clyde Tombaugh: Discoverer of Planet Pluto*, by David H. Levy. – Cambridge, Mass.: Sky Publishing Corp., c2006.
- *Explore the Universe Guide: an Introduction to the RASC ETU Certificate Program*, by Brenda Shaw. – Toronto: The Royal Astronomical Society of Canada, [2016]
- *In Search of Time: Journeys Along a Curious Dimension*, by Dan Falk. c2008.

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](mailto:rduff@sympatico.ca)

### Donations to RASC London Centre Library

I wish to thank Henry Leparskas for donating the following book to the RASC London Centre Library, received at the Cronyn Observatory Public Night, Monday, February 12<sup>th</sup>, 2018:

- *Clyde Tombaugh: Discoverer of Planet Pluto*, by David H. Levy. – Cambridge, Mass.: Sky Publishing Corp., c2006.
- We also received the following RASC publication for inclusion in our Library, presented to me by Peter Jedicke at our RASC London Centre meeting, February 17<sup>th</sup>, 2017:
- *Explore the Universe Guide: an Introduction to the RASC ETU Certificate Program*, by Brenda Shaw. – Toronto: The Royal Astronomical Society of Canada, [2016]

### Exploring the Stars Events & Cronyn Observatory Public Nights, Exploring the Stars & Special Events, February — March 12th — April 10th 2018

*By Robert Duff*

#### Cronyn Observatory Public Night, Monday, March 12<sup>th</sup>, 2018

The school mid-winter "March Break" (March 12<sup>th</sup>—16<sup>th</sup>) may have accounted for the unusual number of 132 visitors to Western University's Cronyn Observatory Weekday Public Night, Monday, March 12<sup>th</sup>, 2018, 8:00 p.m. Graduate student Dan Hatfield welcomed visitors who soon filled the lecture room. RASC London Centre was represented by Everett Clark, Bob Duff and Peter Jedicke.

Normally, there is no slide presentation for a Cronyn Observatory Weekday Public Night. However, since cloudy skies seemed to rule out observing and given the large number of people, Everett suggested a slide presentation. Dan presented the digital slide presentation “*Our Solar System*” to a full lecture room and

fielded questions. Peter counted 70 visitors by 8:18 p.m., including 64 in the lecture room and 6 in the dome. Peter counted 132 visitors in total by the end of the evening.

Everett made ready the big 25.4cm refractor (32mm Erfle eyepiece, 137X) in the dome and Bob directed it towards the double star Castor. Everett also set up the London Centre's 25.4cm Dobsonian on the observation deck, with Bob locating Castor in the 17mm Nagler eyepiece (66X) field of view. However, since Castor was already being viewed through the 25.4cm refractor, Everett suggested another object be viewed through the 25.4cm Dobsonian. Throughout the evening Everett showed visitors Castor through the 25.4cm refractor and Bob showed them the Pleiades (M45) star cluster through the 25.4cm Dobsonian.

After giving the slide presentation, Dan went downstairs into the “*Black Room*” and gave several demonstrations of the “*Transit Demo*” model—showing how the transit detection method worked for finding extra-solar planets—as well as the “*Spectroscopy Demo*,” with the visitors putting on *diffraction grating* glasses to view the spectra of 4 gas discharge lamps, including: hydrogen, helium,



neon and mercury. Dan also gave a tour 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. The “1940s Period Room,” were designed by RASC London Centre member Mark Tovey.

Bob answered many questions as he showed visitors the Pleiades through 25.4cm Dobsonian and also gave a tour of the “1940s Period Room” to a couple of visitors towards the end of the evening. The visitors were gone by around 10:00 p.m., after an enjoyable evening learning about astronomy and observing through telescopes in the cloudy, later clearing sky.

### **Exploring the Stars, London District Catholic School Board Grade 7 Enrichment Class, March 20<sup>th</sup>, 2018**

Clear skies with a few high wispy clouds greeted 24 visitors (10 students and 14 adults, including the teacher and parents) from the London District Catholic School Board Grade 7 Enrichment Class, for Exploring the Stars at Western University’s Cronyn Observatory, Tuesday, March 20<sup>th</sup>, 2018, 6:30 p.m. Graduate student Dan Hatfield presented the digital slide presentation “*The Life and Times of Stars*” and fielded questions. This was followed by demonstrations of the “*Transit Demo*” and “*Spectroscopy Demo*” in the downstairs “*Black Room*.”

Downstairs in the “*Black Room*” Dan did the “*Transit Demonstration*” activity, with the “*Transit Demo*” model—showing how the transit detection method worked for finding extra-solar planets—as well as the “*Spectroscopy Demonstration*,” with the visitors putting on *diffraction grating* glasses to view the spectra of 4 gas discharge lamps, including: hydrogen, helium, neon and mercury.

RASC London Centre was represented by Everett Clark and Bob Duff. Everett made ready the big 25.4cm refractor (Meade 28mm Super Wide Angle eyepiece, 157X) in the dome and set up the London Centre’s 25.4cm Dobsonian on the observation deck. Bob installed the 17mm Nagler eyepiece (66X) in the 25.4cm Dobsonian and directed it towards the wind turbine on the Engineering building. When everybody arrived upstairs in the dome, Bob gave a talk on some of the history of the Cronyn Observatory and technical aspects of the big 25.4cm refractor. He explained the Schmidt camera and Cassegrain reflector piggy-backed on the 25.4cm refractor—opening and closing the shutter on the Schmidt camera for demonstration. He also called their attention to the 2 clocks on the east wall of the observatory and explained the difference between Standard and Sidereal Time.

Everett then directed the 25.4cm refractor towards the 3-day-past-new crescent Moon in the bright early evening western sky, which made a fine sight for the visitors through the Meade 28mm SWA eyepiece (157X). Dan and Everett tried using the hour angle and declination coordinates from the planetarium software on the computer to locate the double star Castor, and Everett soon centred it in the 25.4cm refractor’s field of view after Bob pointed out Castor and Pollux in the twilight sky. Bob showed the visitors the Moon, and later the star Sirius, through the 25.4cm Dobsonian (17mm Nagler eyepiece, 66X) set up on the observation deck.

The visitors enjoyed the views through the 2 telescopes and asked many good questions. Everybody was gone by around 8:30 p.m. after a very interesting evening of astronomy under clear skies.

### **Exploring the Stars, 1<sup>st</sup> St. Thomas Brownies, March 22<sup>nd</sup>, 2018**

Clear skies greeted 25 visitors (12 children and 13 adults) from the 1<sup>st</sup> St. Thomas Brownies for Exploring the Stars at Western University’s Cronyn Observatory, Thursday, March 22<sup>nd</sup>, 2018, 6:30 p.m. Graduate student Jeff Vankerkhove made the digital slide presentation “*The Scout / Guide Astronomy Badge*” and fielded questions. Jeff followed this with the “*Constellations*” activity, distributing 25 “*Star Finder*” planispheres, showing the visitors how to assemble them with adhesive tape, and demonstrating how to use them to locate constellations in the sky.

RASC London Centre was represented by Everett Clark and Bob Duff. Everett directed the big 25.4cm refractor in the dome towards the 5-day-past-new Moon, installing the Meade 28mm Super Wide Angle eyepiece (157X). Everett also set up the London Centre’s 25.4cm Dobsonian (17mm Nagler eyepiece, 66X) on the observation deck and directed it towards the Moon. When everybody arrived upstairs in the

dome, Bob gave a talk on some of the history of the observatory and technical aspects of the 25.4cm refractor. The visitors then lined up to view through the telescopes, with Everett showing them the Moon and later the double star Castor—which was nicely resolved in the 25.4cm refractor (157X). Bob also showed them the Moon through the 25.4cm Dobsonian, as well as the double star Castor which was just resolved in the 17mm Nagler eyepiece (66X).

Towards the end of the evening Jeff gave a shortened demonstration of the “*Spectroscopy Demonstration*” in the downstairs “*Black Room*,” with 10—15 visitors (children and adults) putting on *diffraction grating* glasses to view the spectra of 4 gas discharge lamps, including: hydrogen, helium, neon and mercury. The visitors were gone by around 8:30 p.m. after a very enjoyable evening of astronomy under clear skies.

### **Cronyn Observatory Public Night, Saturday, March 24<sup>th</sup>, 2018**

Clear skies greeted an estimated 180 visitors to the Western University Cronyn Observatory Public Night, Saturday, March 24<sup>th</sup>, 2018, 8:00 p.m. Graduate student Viraja Khatu made 3 presentations of the digital slide presentation “*Death of Stars*.” RASC London Centre was represented by Everett Clark, Henry Leparskas, Bob Duff, Mark Tovey and Edith Tovey. Professor Paul Wiegert, who is also a RASC London Centre member, also assisted on the observation deck.

Bob counted 69 visitors in the lecture room at 8:05 p.m. for Viraja’s first slide presentation, as well as 16 people in the downstairs “*Black Room*,” 11 in the entrance and stairwell and 19 in the dome and observation deck by 8:10 p.m. Viraja counted 50 visitors for her second slide presentation at 8:45 p.m. and 7 for her third presentation at 9:40 p.m. In all, Bob estimated some 150—200 visitors with the final estimate of 180 visitors suggested by Everett.

Upstairs in the dome, Everett Clark operated the big 25.4cm refractor (Meade 28mm Super Wide Angle eyepiece, 157X), showing visitors the first quarter Moon, the double star Castor, and then the Moon again. Professor Paul Wiegert and London Centre member Bob Duff set up the London Centre’s home-built 30.5cm Dobsonian on the observation deck. Bob showed visitors the Moon, the Orion Nebula (M42) and later the Moon again through the London Centre’s 30.5cm Dobsonian (18mm Radian eyepiece, 83X). Professor Paul Wiegert showed visitors the Moon through the London Centre’s 25.4cm Dobsonian (17mm Nagler eyepiece, 66X).

Downstairs in the “*Black Room*” Henry Leparskas did the “*Transit Demonstration*” with the “*Transit Demo*” model—showing how the transit detection method worked for finding extra-solar planets—as well as the “*Spectroscopy Demonstration*,” with the visitors putting on *diffraction grating* glasses to view the spectra of 4 gas discharge lamps, including: hydrogen, helium, neon and mercury. Henry, and later 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 150<sup>th</sup> anniversary of Confederation—Canada 150. Edith Tovey assisted with the “*Period Rooms*” tours. Both “*Period Rooms*” were designed by Mark Tovey.

The visitors were gone from the dome by 10:20 p.m. and from the downstairs “*Black Room*” and “*Period Rooms*” before 10:50 p.m. after a very enjoyable evening learning about astronomy and observing through telescopes.

### **Exploring the Stars, Covenant Christian School, Grades 5-6, March 27<sup>th</sup>, 2018**

Cloudy skies and rain greeted 31 visitors, including 25 children and 6 adults (one teacher and parents) from the Covenant Christian School (Grades 5-6) in Lambeth, for Exploring the Stars at Western University’s Cronyn Observatory, Tuesday, March 27<sup>th</sup>, 2018, 10:00 a.m. They were welcomed by graduate students Jeff Vankerkhove and Dan Hatfield. Jeff presented the digital slide presentation “*Our Star: The Sun*” and fielded questions. This was followed by the “*Building Sundial*” activity, with Jeff demonstrating how to cut out and assemble a sundial from a pattern on a printed sheet of paper and Dan going around and helping the children as they cut out and assembled their own sundials.

Since cloudy, rainy weather ruled out solar observing, RASC London Centre member Bob Duff installed the observatory's 90mm Coronado H-Alpha Solar Telescope (CEMAX 25mm eyepiece, 32X) on the Sky-Watcher EQ5 mount and set up the London Centre's 25.4cm Dobsonian with the 17mm Nagler eyepiece for demonstration inside the dome. Bob also set up the observatory's Meade 8-inch (20.3cm) Schmidt-Cassegrain (26mm Plossl eyepiece, 77X) inside the dome so as to view the Western Sports & Recreation Center building, through the door to the observation deck.

When everybody arrived upstairs in the dome, Bob gave a talk on some of the history of the observatory and technical aspects of the big 25.4cm refractor, using the 32mm Erfle eyepiece (137X) for demonstration. He also explained how the Schmidt camera worked—demonstrating how the shutter opened and closed—as well as the Cassegrain reflector telescope piggy-backed on the 25.4cm refractor. He explained the difference between a reflector and refractor telescope and showed them the 25.4cm Dobsonian reflector and 20.3cm Meade Schmidt-Cassegrain telescopes. Bob briefly explained how the 90mm Coronado H-Alpha telescope was used to observe prominences the Sun. He also explained the 2 clocks on the east wall and the difference between Standard and Sidereal Time. Jeff demonstrated how the 90mm Coronado H-Alpha telescope worked on the computerized Sky-Watcher EQ5 mount and Bob invited the visitors to view the Western Sports & Recreation Center building through the 20.3cm Meade Schmidt-Cassegrain telescope.

Dan and Jeff then brought everybody downstairs into the "Black Room" where Dan did the "Transit Demonstration" activity, with the "Transit Demo" model—showing how the transit detection method worked for finding extra-solar planets—as well as the "Spectroscopy Demonstration," with the visitors putting on *diffraction grating* glasses to view the spectra of 4 gas discharge lamps, including: hydrogen, helium, neon and mercury.

After the demonstrations in the "Black Room," Dan and Jeff brought the visitors back into the lecture room and had them fill out feedback forms. The visitors were gone by 11:50 a.m., after an interesting and enjoyable morning learning about the Sun, telescopes, the transit detection method for finding extra-solar planets and spectroscopy.

### Exploring the Stars, Sir Arthur Currie Public School, Grade 6, April 3, 2018

Cloudy skies greeted 24 visitors, including 22 students and 2 adults (the teacher and one parent volunteer), from the Sir Arthur Currie Public School, Grade 6, for Exploring the Stars at Western University's Cronyn Observatory, Tuesday, April 3, 2018, 11:00 a.m. Graduate student Jeff Vankerkhove presented the digital slide presentation "Our Star: The Sun" and fielded questions. This was followed by the "Building Sundial" activity, with Jeff demonstrating how to cut out and assemble a sundial from a pattern on a printed sheet of paper (with the caption "I Tell Only Sunny Hours") and then helping the students cut out and assemble their own sundials.

RASC London Centre was represented by Henry Leparskas and Bob Duff. Since cloudy skies ruled out solar observing and the weather forecast was for rain in the afternoon, Henry set up the London Centre's 25.4cm Dobsonian inside the door to the observation deck so as to view the wind turbine on the Engineering building. Bob installed the observatory's 90mm Coronado H-Alpha Solar Telescope (CEMAX 25mm eyepiece, 32X) on the Sky-Watcher EQ5 mount and, together with Henry, set up the Meade 8-inch (20.3cm) Schmidt-Cassegrain (20mm Plossl eyepiece, 100X) inside the dome so as to view the communications tower in south London through the door to the observation deck. Henry opened the dome and directed the big 25.4cm refractor towards the communications tower in south London, installing the Meade 28mm Super Wide Angle eyepiece (157X).

When the visitors arrived upstairs in the dome, Bob gave a talk on some of the history of the observatory and technical aspects of the big 25.4cm refractor. Bob briefly explained the difference between a refractor and the 25.4cm Dobsonian and 20.3cm Schmidt-Cassegrain reflector telescopes, and called their attention to the 90mm Coronado H-Alpha telescope for observing the Sun. The students were then invited to view through the telescopes. Henry supervised as they climbed the observing ladder to view the communications tower through the 25.4cm refractor.

Bob supervised as they viewed the tower through the 20.3cm Schmidt-Cassegrain and the wind turbine through the 25.4cm Dobsonian. Jeff demonstrated the 90mm Coronado H-Alpha telescope on the computerized Sky-Watcher EQ5 mount to interested students. Bob briefly explained to the teacher the 2 clocks on the east wall and the difference between Standard and Sidereal Time.

Jeff then brought everybody downstairs into the "Black Room" where he did the "Spectroscopy Demonstration," with the visitors putting on *diffraction grating* glasses to view the spectra of 4 gas discharge lamps, including: hydrogen, helium, neon and mercury. Jeff brought everybody back upstairs into the lecture room where he had them fill out feedback forms. The visitors were gone by around 1:00 p.m., after an interesting and enjoyable observatory visit, learning about the Sun, sundials, telescopes and spectroscopy.

### Exploring the Stars, 3<sup>rd</sup> London Guides, April 4<sup>th</sup>, 2018

Cloudy, windy weather with snow flurries greeted 24 visitors (19 children and 5 adults / leaders) from the 3<sup>rd</sup> London Guides, for Exploring the Stars at Western University's Cronyn Observatory, Wednesday, April 4<sup>th</sup>, 2018, 7:00 p.m. Graduate student Viraja Khatu made the digital slide presentation "The Scout / Guide Astronomy Badge," with the title slide "The Basics," and fielded questions. Viraja followed this with the "Constellations" activity, distributing 23 "Star Finder" planispheres, showing the visitors how to assemble them with adhesive tape, showing the slide "Reading a Star Finder" and demonstrating how to use them to locate constellations in the sky.

RASC London Centre was represented by Everett Clark, Henry Leparskas and Bob Duff. Weather conditions ruled out opening the dome. When everybody arrived upstairs in the dome, Bob gave a talk on some of the history of the observatory and technical aspects of the big 25.4cm refractor, using the 32mm Erfle eyepiece (137X) for demonstration. Bob explained how the Schmidt camera worked—demonstrating how the shutter opened and closed—as well as the Cassegrain reflector telescope piggy-backed on the 25.4cm refractor. He showed them the London Centre's 25.4cm Dobsonian reflector set up in the dome and explained the difference between a refractor and reflector telescope. Bob also explained the 2 clocks on the east wall and the difference between Standard and Sidereal Time. To demonstrate how the dome moved, Bob removed the counterweight on the chain and Henry invited 2 of the girls to operate the control lever and move the dome.

The Guides were then invited to view the wind turbine on the Engineering building through the 25.4cm Dobsonian (17mm Nagler eyepiece, 66X) set up on a wheeled dolly, just inside the door to the observation deck. This was the first use of one of the two wooden "dollies" with wheels (casters) built by Henry to more easily move the London Centre's Dobsonian telescopes at the Cronyn Observatory.

The Guides were then brought downstairs into the "Black Room" where they were divided into 2 groups for the "Spectroscopy Demonstration" and tour of the "1940s Period Room." Viraja gave 2 demonstrations (one to each group) of the "Spectroscopy Demonstration," with the visitors putting on *diffraction grating* glasses to view the spectra of 4 gas discharge lamps, including: hydrogen, helium, neon and mercury. The "Spectroscopy Demonstration" gas discharge lamps were mounted on the "Black Room" wall by Henry Leparskas on March 15<sup>th</sup>, 2018, so as to no longer take up table space.

Henry gave 2 tours (one to each group) of the historic "1940s Period Room," a recreation of Dr. H. R. Kingston's 1940 office (designed by RASC London member Mark Tovey), with Dr. Kingston's brass refractor and the *Sotellunium*—a mechanical eclipse demonstration model built by W. G. Colgrove—on display. The Guides were greatly impressed by their tour of the observatory and signed the guest book in the "1940s Period Room" before leaving around 9:00 p.m.

### Exploring the Stars, Kensington Village Retirement Home, April 5<sup>th</sup>, 2018

Cloudy, later clearing skies greeted 9 visitors (including 7 residents, the young lady Recreation Supervisor and one young man who was a Personal Support Worker), from the Kensington Village Retirement Home for Exploring the Stars at Western University's Cronyn Observatory, Thursday, April 5<sup>th</sup>, 2018, 6:30 p.m. The event was scheduled to run 7:00—8:15 p.m., but they arrived early and the event began at 6:50 p.m. with the *Sotellunium* demonstration by Henry Leparskas.

Henry Leparskas brought the *Sotellunium*—a mechanical eclipse demonstration model built by W. G. Colgrove—upstairs from the “1940s Period Room” and set it up on the table at the front of the lecture room where he gave a short demonstration to the group. Graduate student Viraja Khatu then presented the digital slide presentation “*The Life and Times of Stars*” and fielded questions. Viraja followed this with the activity “*Kitchen Comet*” making a comet from dry ice and other materials.

RASC London Centre was represented by Everett Clark, Henry Leparskas and Bob Duff. Everett and Bob set up the London Centre’s 25.4cm Dobsonian on the concrete walkway in front of the observatory to accommodate one visitor in a wheelchair and several others having difficulty climbing the stairs to the dome. Everett directed the 25.4cm Dobsonian (17mm Nagler eyepiece, 66X) towards the red light on a tower above the university buildings to the north. A chair was provided and Bob supervised as several visitors viewed through the 25.4cm Dobsonian, including the one man who was in a wheelchair.

Several visitors did make their way upstairs into the dome with some assistance and 2 men saw the planet Venus in the bright evening western sky from the observation deck. Henry directed the big 25.4cm refractor (Meade 28mm Super Wide Angle eyepiece, 157X) in the dome towards Venus, which appeared as a gibbous disk with some blue and orange colour fringing due to atmospheric dispersion near the horizon. Two of the visitors, one man and the young lady Recreation Supervisor, viewed Venus through the 25.4cm refractor. The bus arrived and the visitors were gone by around 8:15 p.m. after an enjoyable visit to the Cronyn Observatory.

#### **Cronyn Observatory Public Night, Monday, April 9<sup>th</sup>, 2018**

Clear skies greeted some 35 (30–40) visitors to the Western University Cronyn Observatory Public Night, Monday, April 9<sup>th</sup>, 2018, 8:00 p.m. They were welcomed by graduate students Amanda DeSouza and Richard Bloch. Since there was no slide presentation, Amanda directed visitors upstairs into the dome and downstairs into the “*Black Room*” and “*Period Rooms*.” RASC London Centre was represented by Everett Clark, Henry Leparskas, Peter Jedicke, Mark Tovey and Bob Duff.

Downstairs in the “*Black Room*” Amanda DeSouza and Richard Bloch did presentations of the “*Spectroscopy Demonstration*,” with the visitors putting on *diffraction grating* glasses to view the spectra of 4 gas discharge lamps, including: hydrogen, helium, neon and mercury. Peter Jedicke 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 Tovey showed them the “*1967 Period Room*,” recreating the early control room of the Elginfield Observatory to celebrate the 150<sup>th</sup> anniversary of Confederation—Canada 150. Both “*Period Rooms*” were designed by Mark Tovey.

Upstairs in the dome, Everett Clark operated the big 25.4cm refractor (Meade 28mm Super Wide Angle eyepiece, 157X) and showed visitors the planet Venus, which appeared as a gibbous disk with orange and blue colour fringing due to atmospheric dispersion near the western horizon. Henry Leparskas pointed out Venus in the bright evening western sky to visitors on the observation deck. Bob Duff and Henry set up the London Centre’s home-built 30.5cm Dobsonian (17mm Nagler eyepiece, 88X) and took turns operating it for the evening. Bob showed visitors the star Sirius, as it appeared in the deepening twilight, and Henry showed them the Orion Nebula (M42) and the double star Mizar, and nearby Alcor, as the sky darkened.

Bob later assisted Everett with focusing the 25.4cm refractor on the double star Castor. Everett swapped in the 18mm Radian eyepiece (244X) for a better view of Castor. The door to the observatory dome was closed to keep indoor warm air from smearing the image in the telescope. The view of Castor through the 25.4cm refractor with 18mm Radian eyepiece (244X) was very much improved. Some clouds appeared overhead towards the end of the evening. The visitors were gone by around 10:00 p.m. after a very enjoyable evening of astronomy.

#### **Exploring the Stars, London 66<sup>th</sup> Beaver Scouts, April 10<sup>th</sup>, 2018**

Partly cloudy sky with hazy clouds greeted 23 visitors (12 children and 11 adults) from the London 66<sup>th</sup> Beaver Scouts for Explor-

ing the Stars at Western University’s Cronyn Observatory, Tuesday, April 10<sup>th</sup>, 2018, 6:30 p.m. Graduate student Jeff Vankerkhove made the digital slide presentation “*Constellations*” and fielded questions. Jeff followed this with the “*Constellations*” activity, distributing 23 “*Star Finder*” planispheres, showing the visitors how to assemble them with adhesive tape, and demonstrating how to use them to locate constellations in the sky.

RASC London Centre was represented by Henry Leparskas and Bob Duff. Henry made ready the big 25.4cm refractor (17mm Nagler eyepiece, 258X) in the dome and directed it towards the planet Venus, visible in the telescope through hazy clouds in the bright early evening western sky. Henry also set up the London Centre’s 25.4cm Dobsonian on the observation deck. Bob installed the 18mm Radian eyepiece (62X) in the 25.4cm Dobsonian and directed it towards the wind turbine on the Engineering building.

When the Beaver Scouts arrived in the dome, Henry advised them to look at Venus through the 25.4cm refractor to take advantage of the increasingly hazy, cloudy sky. Henry supervised at the top of the observing ladder and Bob assisted at the bottom as the Beaver Scouts and adults climbed up the steps to view Venus through the 25.4cm refractor (17mm Nagler eyepiece, 258X) in the dome. On the observation deck outside, Jeff supervised as the visitors viewed the wind turbine on the Engineering building through the 25.4cm Dobsonian (18mm Radian eyepiece, 62X).

Bob then gave a talk on some of the observatory’s history and technical aspects of the 25.4cm refractor. Bob explained how the Schmidt camera worked—demonstrating how the shutter opened and closed—as well as the Cassegrain reflector telescope piggy-backed on the 25.4cm refractor. He explained the difference between a refractor and reflector telescope—mentioning the 25.4cm Dobsonian reflector on the observation deck. Bob also explained the 2 clocks on the east wall and the difference between Standard and Sidereal Time. The visitors were gone by around 8:15 p.m. after an enjoyable and informative evening learning about the constellations and viewing through the telescopes.