Nova Notes

The Newsletter of the Halifax Centre of the Royal Astronomical Society of Canada

PO Box 31011, Halifax, Nova Scotia, Canada B3K 5T9 www.halifax.rasc.ca halifax@rasc.ca

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November/December 2016

St. Croix Observatory

Part of your membership in the Halifax RASC includes access to our observatory, located in the community of St. Croix, NS. The site has expanded over the last few years and includes a roll-off roof observatory with electrical outlets, use of the Centre's new Go-To 400-mm Dobsonian telescope and 100-mm binoculars, a warm-room, and washroom facilities.

Enjoy dark pristine skies far away from city lights and the company of like minded observers searching out those faint "fuzzies" in the night. Observing nights (Fridays close to the New Moon or Saturday backup) are open to both members and their guests. If you are not a key holder and would like to become one, or need more information, please contact the SCO Manager, Tony McGrath.

Upcoming Observing Nights:

December 17 (alt 18)

Meetings usually begin at 7:30 p.m. at Saint Mary's

University in Room 101 of the Atrium Building (AT).

All meeting locations and presentations subject to change

January Speaker: Kirsten Bonson, PhD candidate, SMU Department of Astronomy & Physics

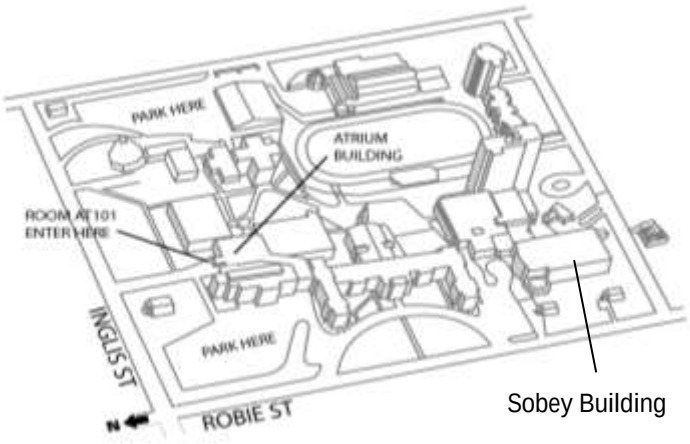
New Frontiers in Astrophysics: from Supermassive Black Holes to Science Education.

High-energy astrophysics plays a key role in shaping our understanding of the universe. As the gap between theory and technology narrows, we have confirmed longstanding suspicions as well as uncovered new mysteries. X-ray observations of active supermassive black holes in particular allow us to probe the most extreme environments in nature, exposing general relativistic phenomena like light bending, time dilation, and more. I will give an overview of my research and will briefly discuss my work in science communication to inquiring minds of all ages.

Meeting Location:

Saint Mary's University

Atrium Building (AT)
Room AT 101
The Atrium is located in front of the Patrick Power Library, between the Burke Building and Science Building.



Meetings are usually held on the third Friday of the month, except for the months of July and August, when there are no meetings.

Executive meetings begin at 6:30 p.m., usually in room AT306, and all members are welcome.

Halifax RASC Executive, 2016:

Honorary President	**Dr. Roy Bishop**	**rlb@eastlink.ca**
President	**Paul Gray**	**snpgray@gmail.com**
1st Vice-President	**Dave Chapman**	**dave.chapman@ns.sympatico.ca**
2nd Vice-President	**Ian Anderson**	**taursagroup@yahoo.ca**
Secretary	**Judy Black**	**jblackns@icloud.com**
Treasurer	**Jim Millar**	**jim.govdoc@gmail.com**
Nova Notes Editor	**Tony Schellinck**	**schell@dal.ca**
Librarians	**Andy and Elli Hasler**	**andyhasler@hotmail.com**
SCO Manager	**Tony McGrath**	**tony.g.mcgrath@gmail.com**
Observing Chair	**Sean Dzafovic**	**sdzafovic@gmail.com**
National Representative	**Dave Chapman**	**dave.chapman@ns.sympatico.ca**
Councillor & Nat. Co-Chair	**Patrick Kelly**	**patrick.kelly@dal.ca**
Councillor	**Quinn Smith**	**quinnjem@yahoo.com**
Councillor	**Chris Young**	**cjy@eastlink.ca**
Councillor	**Paul Heath**	**pheath@eastlink.ca**

In this issue:

From the editor *Tony Schellinck*

This is a shorter issue than normal, yet still it is full of great information and photos. The usual columnists are here and we have an excellent report covering the November Centre meeting and our outreach at the 2016 Hal-Con Weekend.

▲ Tony helps students find DSOs with binoculars (*Photo: Heather Schellinck*).

I just finished teaching a six-week course for the Seniors College Association of Nova Scotia (SCANS) at the Astor Theatre in Liverpool. The course was entitled A Practical Guide to Observing the Night Sky. There were 36 registered from as far away as Yarmouth and Halifax. In the photo to the class is practicing with their binoculars to find a DSO on the screen at the far end of the theatre. They learned the constellations, how to navigate around the night sky and how to use their binoculars to find DSOs in each of the four seasons. I had a lot of fun offering the course and those who attended were keen to get out under the stars to test their newly formed skills.

Cover Photo
Michael Boschat

Moon Tonight
Nov 11, 2016

Taken through my open front window, kept the heat off again. C8 + 40-mm eyepiece, used an old Samsung smartphone and just held it over the eyepiece. It had to be held about 1-2 inches from the eyepiece to get the image. The data on the image is... for 40-mm = 1/67 sec. exposure, f/2.6, fl=4 mm, and ISO 80.

I have limited viewing because of leaves still on a tree, so I left the camera in auto mode.

Halifax Centre Annual General Meeting (AGM)

It is required in our Bylaw #1 to hold an AGM between October 1 and December 31 every year. **The RASC Halifax Centre AGM is Friday, December 9, 2016 at 7:30 - 9:30 PM at SMU in the Atrium Room 101.**

Why attend?
1- This is your opportunity to obtain first hand knowledge of the Centre and its performance in the past year. Further information and clarifications on any transactions carried out by the Centre can also be requested while you are face-to-face with Council.
2- Pat Kelly will be giving a brief presentation on his recent trip to Iceland. Come and hear how he stumbled across "An Unexpected Solar System".
3- The RASC Halifax Centre Bylaw #1 and its Objectives have been revised. There will be special resolutions for approval of them. If you have not received a copy for review, please contact Judy Black at jblackns@icloud.com .
4- There will be an election of the new Council. Come and find out who will be leading the Centre in 2017!
5- Another important reason? There will be a social time following the AGM where you can enjoy some Christmas cheer with fellow astronomers from across the province.

So please mark December 9 in your Calendar. See you there!

Nova Notes: The Newsletter of the Halifax Centre of the RASC

PO Box 31011, Halifax, Nova Scotia, B3K 5T9

E-mail: novanoteseditor@rasc.ca Newsletter Editor: Tony Schellinck

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The deadline for the next edition is February 20, 2016
The opinions expressed herein are not necessarily those of the Halifax Centre.
Articles on any aspect of astronomy and related activities will be considered for publication.

The 2016 Hal-Con Weekend: Star Wars meets RASC

Paul Heath

The 2016 Hal-Con weekend was held at the World Trade and Convention Centre and Scotiabank Centre on the weekend of November 4th to 6th (next year September 22—24). A record number of 8,800 people attended this year's event. RASC Halifax purchased a table located in the societies section of the exhibitor hall and I brought the posters, handouts and other items displayed at the table. Our display time went from noon on Friday until 5 pm on Sunday.

Friday proved to be a very good day as we spoke at length to 63 people while dozens of others just listened or collected brochures. Saturday morning was slow but by the afternoon the conversations with people were steady. We had 53 people who stopped to talk while others picked up materials.

▲ Tony Schellinck and Lilian Zhang are prepared to talk astronomy with Hal-Con geeks (*Photo: Paul Heath*)

Sunday proved to be an excellent day with 98 stopping and discussing astronomy with those at the table. Over the weekend 78 Star Finders, 62 moon Guides and 130 Center brochures were handed out.

I would like to thank Lilian Zhang, Wayne Harasimovitch, Tony Schellinck and Sean Dzafovic for coming out to help.

A large percentage of those in costume that stopped to talk were dressed as 'Rey' from the new Star Wars movie. Is this a new trend? Will a new SF female heroine encourage young women to look into astronomy? On Saturday a young girl dressed as 'Rey' was beside our table building a Robot and overheard me ask this question. She said 'Yes". She said that the character of 'Rey' had encouraged her to switch to more sciences in college. I wonder if we will get a new group to our meetings now.

Being beside the armor repair table again this year let us see many awesome costumes.

We had a number of people ask about helping them figure out their telescopes, and two schools have asked that we come in and look at their donated scopes to see if they are usable. There was a lot of interest in our meetings and many commented that they did not know we existed! Hopefully we have changed this situation a little.

Sunday was by far the best day. It was steady right from the start with a number of other vendors coming over. Three times we had to supply the correct answer to an 'ASTROLOGY" argument (our side won!). The one thing I did notice is that far fewer people asked us if we were the 'ASTROLOGERS' then at other events such as the RV show, Saltscapes, and sadly the Science Teachers Conference. Instead, those who stopped took the time to learn about observing and showed genuine interest in it as an activity they might pursue.

Overall it was a fun weekend, but it was cold sitting above the ice. This is a great venue for us and hopefully we will see some new faces at our meetings.

Paul Heath
RASC Outreach

Starlight and Semiconductors

Art Cole

Nowadays, most Nova Scotians are familiar with digital camera technology. In fact, it is so ubiquitous in our lives that we use it every day without even thinking about it. We have digital cameras in our phones, our cars, and our computers, and they have become part of our daily lives. But what many Nova Scotians may not know is that the inventor of the original digital camera sensor was born in their province and won the 2009 Nobel Prize in Physics for his invention.

Willard Sterling Boyle was born in 1924 in Amherst, Nova Scotia, and lived in Wallace until the age of two. His family moved to Chaudière, a logging community in northern Quebec, where Boyle's father worked as the local physician. Boyle was home-schooled by his mother until age 14, and attended high school at Lower Canada College in Montreal. Boyle began his post-secondary education at McGill University, which was soon interrupted by World War II. In 1943, he joined the Royal Canadian Navy and was trained as a Spitfire pilot. After the war, Boyle returned to McGill to continue his studies. He married his wife Betty in 1946, and completed his Bachelor's degree in 1947, his Masters in Science in 1948, and his Doctorate in Physics in 1950.

After teaching at McGill and the Royal Military College of Canada, Boyle decided to take up a new opportunity at Bell Laboratories in New Jersey. In 1962, Boyle co-invented the first continuously-operating laser with Don Nelson, and

▲ Willard Boyle, left, and George Smith, right, at Bell Labs in 1970.

assisted in the selection of lunar landing locations for the Apollo space program.

In 1969, while brainstorming ideas for a new memory device, Boyle and his colleague George Smith came up with the idea of a linear semiconductor device containing electronic "charge wells". The amount of electric charge in each of these wells would be capable of being shifted along the device and read out at one end, like passing buckets along a bucket brigade, with the person at the end looking in each bucket to see how much water it contains. Boyle and Smith named their invention the Charge-Coupled Device, or CCD. They knew that the CCD could act as several devices, including a shift register, an electronic time delay, computer memory, and with some adaptations, an optical sensor.

Instead of clocking information into the CCD at one end and reading it out of the other end, they pre-charged each of the wells to collect electrons when they became available. By allowing photons to strike the device, free electrons were generated in each well due to the photoelectric effect, with the number of electrons generated and stored in each well being directly proportional to the number of electrons hitting it. By building a grid of wells and adding optics in front of it to focus light, the CCD was capable of taking a photograph. With the improvements in semiconductor manufacturing technology in the years following, the CCD went from a simple eight-well linear device (essentially eight pixels in a string), to optical sensors containing millions of pixels.

▲ Willard Boyle in 2005.

The CCD revolutionized photography, making photographic film obsolete, and was incorporated into millions of devices - most notably, consumer digital cameras. Perhaps no other scientific field was revolutionized by the CCD as much as astronomy, where CCDs enable extremely long duration exposures that are scientifically accurate, high-quality, and can be stored and processed on a computer. CCDs are used by amateur and professional astronomers alike, being used on backyard scopes, huge observatories, and in orbiting space telescopes. Boyle and Smith saw this coming revolution. In later years, Smith said, "we could also see the imaging potential immediately… After making the first couple of imaging devices, we knew for certain that chemistry photography was dead."

In 1979, Boyle retired and sailed his sailboat from New Jersey back to Wallace, Nova Scotia, where he lived for the next 32 years. He participated in the Research Council of the Canadian Institute of Advanced Research and the Nova Scotia Council for Applied Science and Technology. In 2009 he received the Nobel Prize for the invention of the CCD, and in 2011 was appointed a Companion of the Order of Canada. Willard Boyle passed away on May 7, 2011 in Wallace. His life and accomplishments are commemorated with a thought-provoking monument at the Wallace Museum.

November 2016 Meeting Report

Jim Millar

President Paul Gray opened the meeting with a welcome to members and visitors alike. He announced that astrophotographer Ron Brecher would be at SMU at 7 PM on Wednesday, November 23. All are welcome

Paul next made a presentation of a certificate for the new Observe the Moon (Telescope Version) to Jim Millar. Jim completed the program as part of the development with Dave Chapman. He wasn't the first to finish but he was the first to apply. Melody Hamilton has also finished the program.

The membership was reminded of the Annual General Meeting to be held at 7:30 PM on December 9, 2016. The president made a call for nominations for the new Council. Andrew Frank offered his name for a councillor position. It was also announced that new by-laws would be presented at the meeting. A version of the by-laws had been circulated to the membership in October. Another version would be circulated in the next week.

Paul Heath presented on outreach. The Hal-Con table received a great deal of attention throughout the weekend. He noted that many of the attendees were dressed as Rey from the newest Star Wars movie. It seems that women heroes in movies are attracting women to science. He also mentioned that there are many opportunities to be involved in outreach programs. Contact Paul if you are interested.

The first of the member presenters was new member John Read. John is originally from Halifax but has spent the last ten years in the US. He has returned to Halifax to complete his degree in astrophysics at SMU. We are happy to have him as a new member. He presented on his experience providing "Outreach South of the Border." He was involved with a program that provided mentors to troubled, inner city kids four at a time for four years. His philosophy of outreach was to make it interesting and to see cool things. He then taught telescope basics to allow kids to return and look at things if they were interested. John was involved with the Astronomical Society of the Pacific and other organizations in the San Francisco Bay area. John has written several books to explain astronomy to the uninitiated. He gave

Paul Gray presents Jim Millar with a certificate for the new Observe the Moon challenge (Telescope Version) (*Photo: Dave Chapman*).

John Read presents on his experience providing "Outreach South of the Border." (*Photo: Dave Chapman*).

A portion of the vestry ceiling of St. Mary's Church, Beverley, Yorkshire, showing Orion and the Pleiades. (*Photo: Dave Chapman*).

November 2016 Meeting Report continued
Jim Millar

some as prizes for pop quizzes that he interspersed in his presentation.

Dave Chapman followed with some photos from his recent trip to England for Quinn Smith's wedding. He was especially interested in the starry ceilings of St. Mary's Church. Many of the ceilings had pictures of stars but the vestry ceiling was the highlight with many of the constellations recognizable.

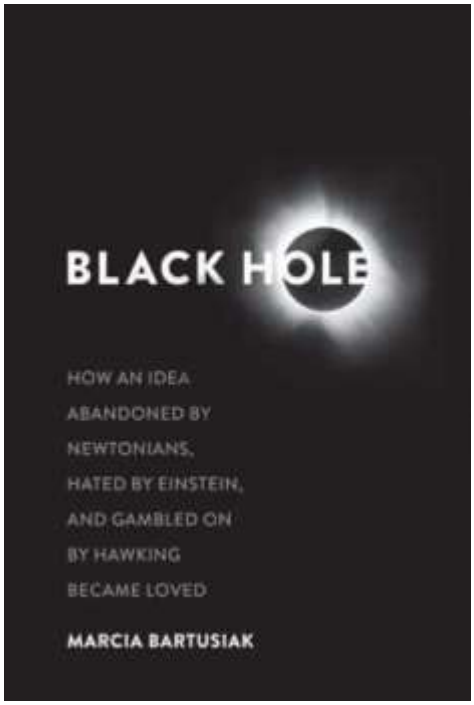
Paul Gray finished off the member presentations with a slide show of recent pictures provided by the members. He then presented on the building of his backyard observatory in Greenwood. We now have the Gray Valley Observatory. He built a shed with a roll-off roof that he designed himself. He discussed how he had built for quality with as little outlay as possible. He indicated that he has spent much more time observing and has returned to astrophotography now that it is so convenient to get out there and observe.

Sean Dzafovic rounded off the evening with "What's Up."

Members socialized and enjoyed the treats after the meeting.

Black Hole by M. Bartusiak
Tony McGrath

Black Hole – How an idea abandoned by Newtonians, hated by Einstein and gambled on by Hawking became loved
Marcia Bartusiak
Yale University Press 225 pages,
ISBN 978-0-300-21966-1



The trouble with black holes is that they exist on the edge of our understanding. There is something counterintuitive about these constructs of nature that has caused endless trouble for their acceptance. Marcia Bartusiak does a wonderful job of taking us through the story of how human understanding and acceptance of these singularities came about.

When Newton published his theory of gravity, light was still considered to be corpuscular, that is to say made up of small particles. In 1783 an Englishmen named Mitchell proposed that stars, because of their mass, must slow down these light particles, and if a star was massive enough, could prevent light particles from escaping at all. By 1915 Einstein had developed his General Theory of Relativity, and soon after that Karl Schwarzschild calculated that one of the consequences of Einstein's work was the idea that a region existed around extremely massive objects where nothing, including light, could escape.

The notion of matter behaving in such a way as to create these extremely massive singularities seemed preposterous, and many of the leading figures of the science community of the early 20th century cast doubts on the whole notion. By the 1930s some in the astronomy community were beginning to realize that the fate of stars was very much influenced by the amount of mass that they contained, and that Einstein's theories were providing new insights not available through classical physics. By the 1950s academia was starting to apply relativity to the study of gravity. By the 1960s radio astronomy was producing some very intriguing observations, and the whole notion of black holes went mainstream. By the 1970s "black hole" had entered the lexicon of the scientific community.

Bartusiak's writing keeps the science simple and focuses on the people and the development of an idea. The book contains some fascinating stories that help you understand just how awkward and lurching the journey of human understanding can be. The example of Roger Babson comes to mind, a wealthy businessman who founded the Gravity Research Foundation in 1948 to find antigravity, and who inadvertently revived interest in general relativity and brought it from a "cozy backwater" to a flourishing field of scientific endeavor. The book's final chapter talks about the efforts to bring gravity and quantum mechanics together as we search for a theory of everything

Black Hole is a lively and dramatic read, and the author does a fine job guiding us along the twisted route that has led to our present understanding. The use of analogies, diagrams and pictures (one by RASC Halifax's Roy Bishop) is appropriately done.

The Super Moon and Radio Astronomy by Matt Payne continued from Page 8

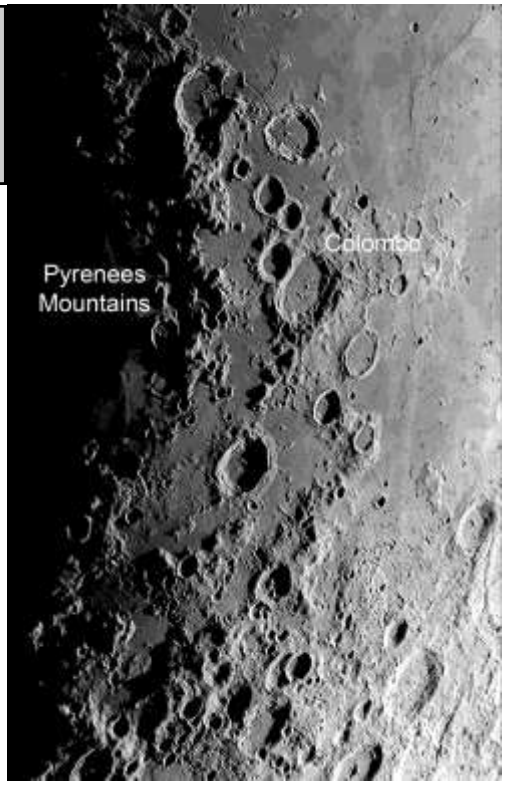
Second, once all that material and gear is up on the Moon to construct your radio telescope, you would then have to send people and robots to build the radio telescope. That would in turn require people to live on a lunar base of some sort for extended periods of time. Lastly, the harsh environment of space would batter man and radio telescope on the Far Side. Remember, the Moon has no atmosphere so cosmic rays, CME's from the Sun, and meteors from space would constantly put the radio telescope in jeopardy. However, this is not to say someone would not try putting a radio telescope on the Far Side of the Moon. China looks to land on the Far Side of the Moon by 2020 with its Chang'e 6 mission; possibly placing instruments on the far side away from the effects of the radio noise generated by Earth. We will all have to wait and see if this mission is successful. So next time you take a look up at the Moon, gazing at all its craters and features we can see from down here on Earth, don't forget to also think of the Moon and its contribution to radio astronomy and radio science.

Lunatic Ramblings 6: Mountains and Prominent Craters

Dave Chapman

Good news! *Explore the Moon* is now an official RASC observing program with certificate! For details, see www.rasc.ca/observing/explore-the-moon-observing-certificate . These Nova Notes columns (starting in April 2015) take you through this program (with occasional detours), night by night. This issue, we review features visible around Q-day –3, that is, about 3 nights *before* First Quarter. That's 2017 January 2 (or 2016 December 4, if you read this early enough). Bundle up! When the Moon is waxing, Q-day –3 means the Moon is a good-sized crescent, getting easier to see in the southwest, and this time of year you can begin observing pretty early, even before suppertime.

Starting in the north, the prominent craters Atlas (87 km) and Hercules (69 km) are on display, in a region devoid of other strong features. Sharp-eyed observers may see terracing of the inner walls of these craters, which are relatively young (only 1–2 billion years old).



▲The Pyrenees Mountains (*Photo: Robert Reeves*)

About halfway between Atlas and Hercules and Mare Crisium (Q-day –5), look for a wide mountain range, the Taurus Mountains—also look for the crater Newcomb (39 km, Q-day –4).

In the southern hemisphere, look for craters Fractasorius (124 km) and Piccolomini (88 km). Fractasorius is on the southern edge of half-exposed Mare Nectaris (Q-day –2) and is itself partially flooded with lava. Piccolomini has a prominent central peak, one outcome of creation by impact. Northeast of Fractasorius, on the eastern shore of Mare Nectaris, note the Pyrenees Mountains.

That's enough for now—in my next column, perhaps we'll move to Q-day –2 and look around. Email if you have questions or comments!
dave.chapman@ns.sympatico.ca

The Super Moon and Radio Astronomy

Matt Payne

With all the news coverage two weeks ago of the "Super Moon," the closest approach of the Moon to Earth since 1948, it got me thinking about how the Moon and Radio astronomy are related. We all saw the extreme high/low tide cycles in the Bay of Fundy or Halifax Harbor. Even down here in Boston, MA we had a King Tide of nearly 13 feet! Such high/low tide cycles are rare around Boston, the result of which was minor coastal flooding and splash-over of the seawall in front of the building where I work in the Seaport District. At night, keen eyed observers might have also noticed the Moon being slightly brighter than average. But that still leaves the question, "Where does the Moon fit in with Radio astronomy?"

Radio astronomy and the Moon go back decades. Shortly after WWII the United States military began experimenting with bouncing radio waves off the Moon. This was an attempt to use the Moon as a giant radio dish to deflect radio signals to other parts of the Earth. Late in 1946 and early 1947, the United States military achieved successful radio communication by bouncing radio signals off the Moon and back to Earth. Following the United States military's success, United States and Canadian amateur radio operators along with other scientist, completed a point to Moon and back to Earth communication. This communication technique of bouncing a radio signal off the Moon has become known as E.M.E. This is an acronym for Earth-Moon-Earth. As long as the transmitting station and receiving station can both see the Moon, one can achieve a maximum signal coverage area of nearly 19,000 miles by bouncing a radio wave off the Moon and back to Earth! However, radio astronomers, scientist, and amateurs soon discovered that man-made radio noise generated by our own planet, combined with atmospheric noise i.e., lighting, aurora, often made communication via E.M.E. unpredictable and not reliable for day-to-day use. This same effect has been hampering radio telescopes through the world as they too struggle with man-made radio noise and atmospheric noise in their study of space. But the Moon may offer something that is impossible to achieve here on Earth, total radio silence.

After WWII and into the Cold War decades, radio astronomy and its scientists realized the Moon held a unique advantage for radio astronomy and radio sciences. The Moon itself, specifically the far side of the Moon, facing away from Earth, can block all man-made and atmospheric radio noise from Earth. Now before you say, let's build a radio telescope on the Moon there are a few things to consider. First, getting all the materials to the Moon to construct a radio telescope would be an enormous task. Millions of kilograms of material and gear would have to be sent to the Moon via heavy payload rockets. This would cost trillions of dollars and take years to accomplish.

Continued on the bottom of page 7.