




Orbit



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Roger Hill, Editor

I was really looking forward to seeing the Aldebaran grazing occultation (see last month's Orbit, Page 8). It's been a while since I've seen a graze, and I've certainly never seen one with a star as bright as Aldebaran. Former president Steve Barnes alerted me to this, and I saw I was within the 1-sigma limit (better than 50% chance of seeing more than one disappearance). Steve invited me to his place near Lake Huron, but it turned out to be a very busy weekend, and I opted to view from closer to home.

While I was investigating the graze, I realized that my backyard observatory would not be close to ideal, and that I'd very likely get a single event (one disappearance followed by a reappearance), and so I spent some time trying to find the ideal spot. I defined the ideal spot as a place where I, and maybe a couple of others, could park our cars and set up. So, a parking lot would be ideal. I wanted to be about 500 meters south of the "centreline", and I needed to have a good western horizon.

There were two areas that stood out. The first was near Lionhead Golf Course in Mississauga, and the second was a park in Glen Williams, north Georgetown. According to Google Earth, there is a nice little pub by the entrance to the Glen Williams Park which sounded like a good place to warm up afterwards. So that decided it.

It turned out that a couple of other people decided to join me, and while I was reasonably confident that I had worked out everything, there was this little niggling voice that had me wondering if I was correct. Of course, if it was only me and I was wrong, I only had myself to blame. But there were others relying on me and my calculations.

I'd spent some time earlier in the week getting my EQ5 mount working, so I had my fingers crossed. I had somehow managed to misplace the battery charger for my Canon T1i, and so I ordered one from Best Buy, and it managed to arrive in time. My 6" Ritchey-Chretien was working nicely and I was good to go.

I arrived about 10pm for the 11:17pm event, and found that Mark Smith and Martin Pal were already there. Delightfully, there was a little pavilion there which shaded us from the parking lot lights, and whilst it was quite cold, the sky was as perfect as you could hope for, with the possible exception of the "seeing" not being the best.

I got all set up, and then found out that the RA drive on my EQ5 was not working. This meant that I'd have to adjust the mount during the two or three minutes that the occultation would last, but I could deal with that. It meant that I wasn't going to use a Barlow lens, though, to just view the very northern tip of the Moon...I was worried that manually guiding at 2000mm of focal length would cause too much shake to produce a worthwhile video.

And then we were visited by the local constabulary, who noticed us and asked if we were "watching that lunar thing". The officer was offered a look at the Moon through Mark Smith's 10" Dob (and a nice piece of glass it is, too). He said that this was a favourite spot for the local youth to stop by and smoke a little weed (perhaps this explained the car that drove into the parking lot earlier, and then immediately drove back out). After wishing us luck, the officer left us alone.

We recorded 16 different events, including several "partials" or "fade outs". Mark reported that at one point he could still see Aldebaran faintly while the video showed nothing. This is an astonishing observation, because he was looking at only part of a stellar surface, the rest of it being hidden behind the Moon.

If you want to see the videos that were produced by Martin and I, as well as a spectacular one done by the NYAA, go on to our Forum (<http://hamiltonrasc.ca/forum/index.php>), and look in the Chat section. Several other people observed the event, from Guelph, Oakville, Burlington and Milton.

Our videos were examined by the International Occultation Timing Association, and are now part of the scientific record made of this event, making our endeavours all the more worthwhile.

See you next month,

Roger

The front cover image is from Martin Pal, and shows the Moon, and Aldebaran, just above the Moon's northern limb.

What It's Like on a TRAPPIST-1 Planet By Marcus Woo



With seven Earth-sized planets that could harbour liquid water on their rocky, solid surfaces, the TRAPPIST-1 planetary system might feel familiar. Yet the system, recently studied by NASA's Spitzer Space Telescope, is unmistakably alien: compact enough to fit inside Mercury's orbit, and surrounds an ultra-cool dwarf star—not much bigger than Jupiter and much cooler than the sun.

If you stood on one of these worlds, the sky overhead would look quite different from our own. Depending on which planet you're on, the star would appear several times bigger than the sun. You would feel its warmth, but because it shines stronger in the infrared, it would appear disproportionately dim.

"It would be a sort of an orangish-salmon color—basically close to the color of a low wattage light bulb," says Robert Hurt, a visualization scientist for Caltech/IPAC, a NASA partner. Due to the lack of blue light from the star, the sky would be bathed in a pastel, orange hue.

But that's only if you're on the light side of the planet. Because the worlds are so close to their star, they're tidally locked so that the same side faces the star at all times, like how the Man on the Moon always watches Earth. If you're on the planet's dark side, you'd be enveloped in perpetual darkness—maybe a good thing if you're an avid stargazer. If you're on some of the farther planets, though, the dark side might be too cold to survive. But on some of the inner planets, the dark side may be the only comfortable place, as the light side might be inhospitably hot.

On any of the middle planets, the light side would offer a dramatic view of the inner planets as crescents, appearing even bigger than the moon on closest approach. The planets only take a few days to orbit TRAPPIST-1, so from most planets, you can enjoy eclipses multiple times a week (they'd be more like transits, though, since they wouldn't cover the whole star).

Looking away from the star on the dark side, you would see the outer-most planets in their full illuminated glory. They would be so close—only a few times the Earth-moon distance—that you could see continents, clouds, and other surface features. NASA Space Place Astronomy Club Article March 2017

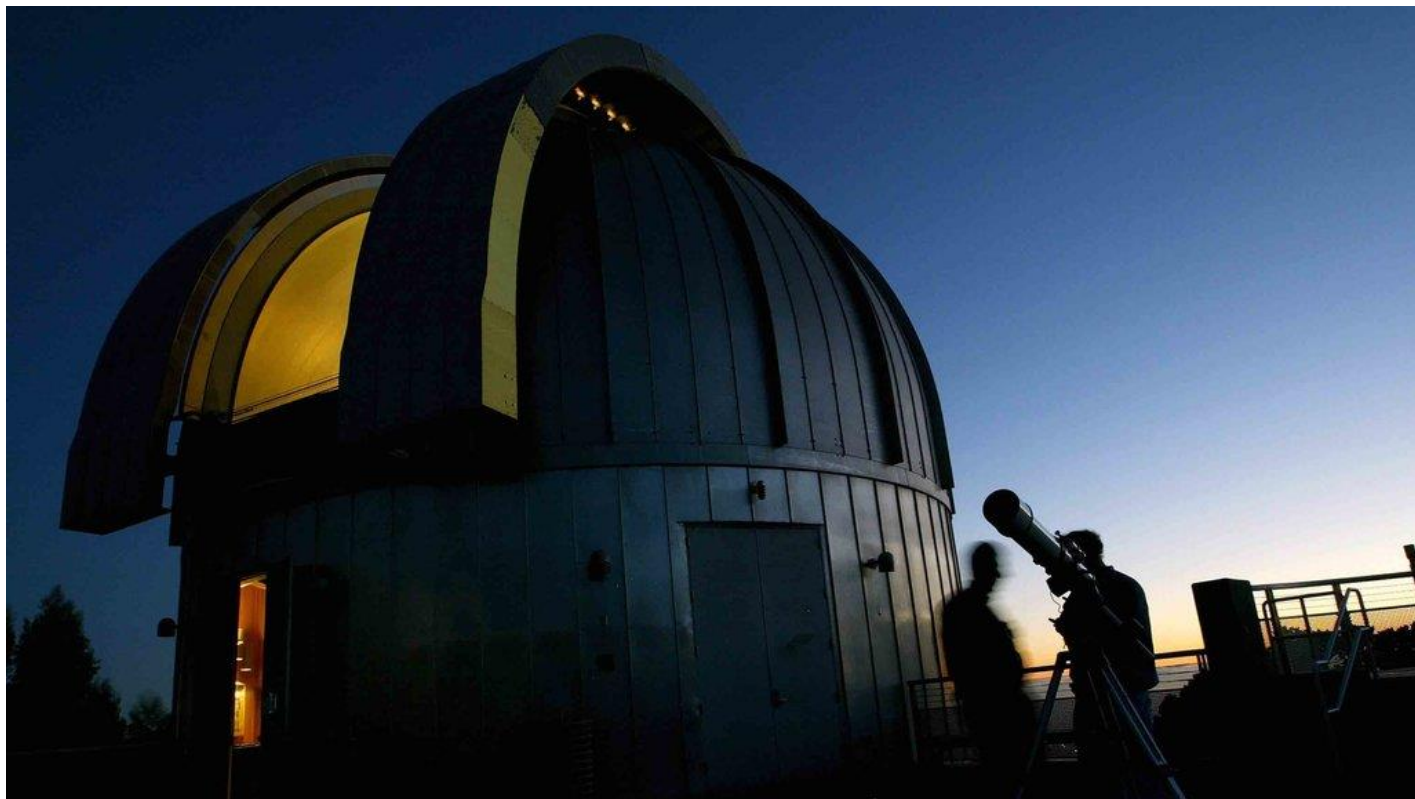
The constellations in the background would appear as if someone had bumped into them, jostling the stars—a perspective skewed by the 40-light-years between TRAPPIST-1 and Earth. Orion's belt is no longer aligned. One of his shoulders is lowered.

And, with the help of binoculars, you might even spot the sun as an inconspicuous yellow star: far, faint, but familiar.

This artist's concept allows us to imagine what it would be like to stand on the surface of the exoplanet TRAPPIST-1f, located in the TRAPPIST-1 system in the constellation Aquarius. Credit: NASA/JPL-Caltech/T. Pyle (IPAC)



Astronomy—The Gateway Drug to Science from BIGTHINK.com



Doing astronomy may be the closest activity we have to science-for-science's-sake — gazing across endless distances to view objects that aren't in the location we currently perceive them to be in. While the common dream of space travel, and the colonization of the solar system, has been a dream for millennia, our ability to make real the promises of space are still several decades off — at least.

If any field appears to be useful only for getting kids interested in science, astronomy might be it. One might then ask: What is the point of getting kids interested in studying astrophysics unless they are going to be astrophysicists? After all, we have other problems to worry about.

Dr. Alex Filippenko, researcher at the University of California, Berkeley and the most cited astronomer in the decade between 1996 and 2006, mounts a convincing defense of pure science. Since being awarded the prestigious Hertz Foundation Fellowship during his graduate studies at the California Institute of Technology, Filippenko has worked on the team that discovered the universe's increasing rate of expansion. Today, he works regularly on the life cycles of stars, especially their spectacular deaths.

This article is part of a series sponsored by The Hertz Foundation. Discover more of what remarkable students can do in the sciences: — Bob Dylan & The Oregon Trail Inspired These 2 Math Problems. Can You Solve Them? He offers us an explanation of why we should support the pure sciences, even if students don't make careers for themselves in such fields.

Above: People wait for the sun to go down to view Mars at the Chabot Space and Science Center in Oakland, California. (Photo by Justin Sullivan/Getty Images)

"Now most kids won't go on into astrophysics, but what they'll do is they'll study science and technology and they'll go into fields that are more immediately useful to society, such as applied physics and engineering and computer science and medical physics, but the bug that bites them is often astronomy. And finally you never know what practical spinoffs there might be and let me give you a few examples.

A century ago when quantum physicists such as Einstein and Bohr and Heisenberg and Schrodinger were developing quantum physics they had not the slightest practical application in mind. They didn't want to make a better toaster or a better bicycle or whatever. They wanted to understand the nature of light and why atoms exist, why atoms are stable, and other such questions...that seem incredibly far removed from our everyday lives.

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Well, fast forward a century. You could not imagine today's high-tech world without an understanding of the microphysics, the quantum world. Look at the silicon revolution for example, look at lasers, look at nearly everything. It all stems from quantum physics. Who would've thought that a century ago?"

Indeed, ideas that changed the world would have been seen as impossible a little over a century ago. Even minds as great as Lord Kelvin's can have a tendency to view the world in fixed terms, where ideas such as "flying machines" and "X-rays" seem like a waste of time. It was the slow application of pure science, such as the realization that quantum mechanics allowed for lasers to exist, that led to the major technological progress we see today.

The study of science, without planned application, can lead to fascinating things in its own right. What physics major has not beheld the Schrodinger equation with a sense of awe at its subtle genius? Who has not read of the vastness of the cosmos and the strange and wonderful items in it and not felt an existential tinge? There is something to the study of pure, non-applicable science which is a reward in itself. The process of discovery that Tesla spoke of which is so great for the scientist that he forgets to eat. Of course, even these moments of pure science can lead to the greatest of applications. As Dr. Filippenko says:

"Who would've thought that a century ago when Einstein was developing the general theory of relativity that it would have this incredible practical application (of GPS)? Sure we might never get close to a black hole, which is an extreme prediction of general relativity, but it doesn't matter. The theory was developed, it's beautiful, it excites kids and it even has practical applications. So with much of astronomy we don't know what the spinoffs will be, but we do know that as humans we can accomplish these goals and we can also excite kids into pursuing areas of science and technology...."

Looking for an application when deciding to do science is a sure way to miss the big picture. Some of the most important, practical, and useful applications of science stem from the most impractical of research, such as relativity. But even if an idea never gives us one iota of practical application, it can go on to inspire young minds with its grandeur. And, in the end, isn't that one of the most important applications science can have?

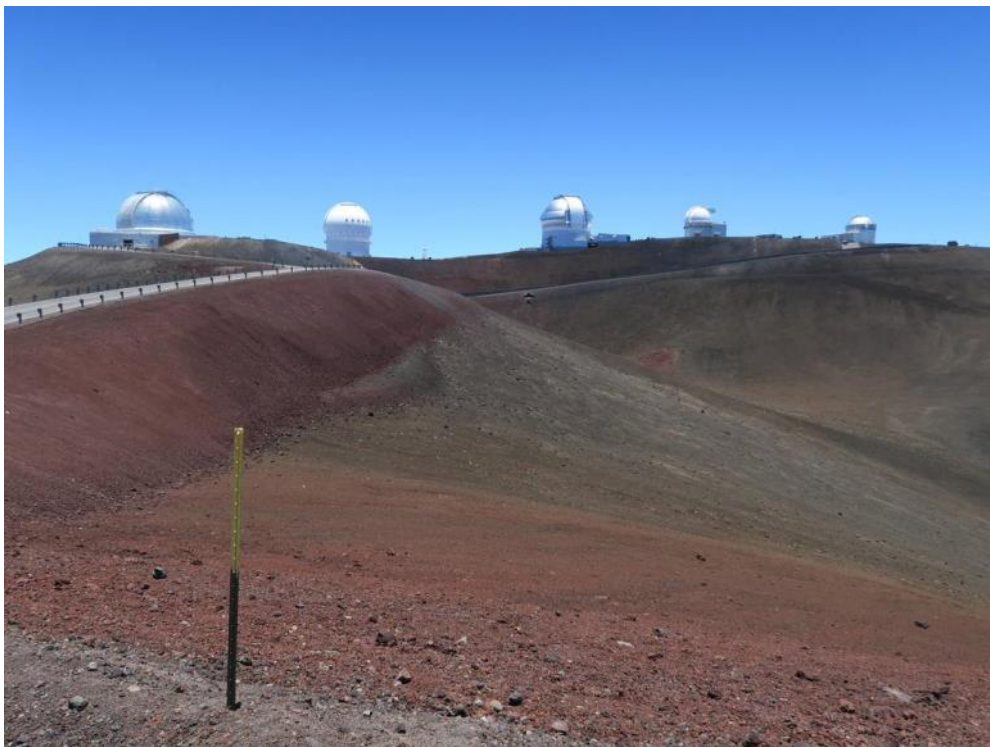
Seeking higher ground to search the heavens by Ivan Semeniuk

Two years ago this week, Ray Carlberg was in seventh heaven.

The University of Toronto astronomer had just learned that then Prime Minister Stephen Harper was about to commit Canada to help build the Thirty Meter Telescope, one of the largest and most ambitious instruments ever conceived for peering into the cosmos.

As the Canadian point man for the \$1.5-billion science megaproject, Dr. Carlberg had spent years marshalling support for just such a decision. He had campaigned hard to bring colleagues and

bureaucrats onside, making the case that partnership in TMT, as the telescope is known, would give Canada a role in the next big wave of cosmic discoveries – from potentially finding another Earth to capturing the light of the universe’s first stars.



Tight federal budgets and a disinterested government had seemed certain to doom his efforts. But within weeks of a final deadline for Canada to join the project, an 11 th-hour decision from the Prime Minister’s Office cleared the way. Canada would allocate \$243.5-million to the giant observatory, Mr. Harper announced on Easter Monday, 2015. The money would go toward building TMT’s enormous dome and supplying part of the telescope’s advanced optical system developed by astronomers at the National Research Council. Astronomers and the Canadian firms most likely to be part of TMT’s construction were ecstatic.

Today, Dr. Carlberg finds himself openly questioning the arrangement he worked so hard to cement. In a surprising reversal, he now advocates that Canada take a hard look at what it’s gotten into – an opinion that triggered his ejection from the TMT board late last year.

“This project is in a lot of trouble,” Dr. Carlberg said in an interview with The Globe and Mail. “Part of the reason I raised the alarm is I wanted to give the community time to think about this.”

Many of his colleagues disagree. They remain emphatic that the best future for Canadian astronomy lies with TMT.

At its roots, the unforeseen controversy is about one thing: Location, location, location.

When Canada officially signed on to TMT, the telescope was slated for construction atop Mauna Kea. The Hawaiian peak rises 4.2 kilometres above sea level and is already home to several major observatories, including the Canada-France-Hawaii Telescope. It is universally acknowledged to be the best site for astronomy in the northern hemisphere.

But TMT’s plans at Mauna Kea have been stalled by protesters who regard the mountain as sacred to native Hawaiians and who seek to prohibit further development of scientific facilities there. For many, the issue has become part of a complex and politically charged discussion over Hawaiian identity.

On March 4, a Hawaiian court wrapped up nearly five months of hearings in a contested case to determine whether the project can proceed as planned. It will likely be months more before a decision is reached, after which additional proceedings and appeals could follow.

Meanwhile, financial pressures are mounting on TMT’s California-based consortium, to the tune of millions of dollars a month, while the planned observatory is sidelined.

The leaders of TMT have stated that they must determine by October where the telescope is going to be built so that the decade-long construction project can begin without incurring further costs due to delays.

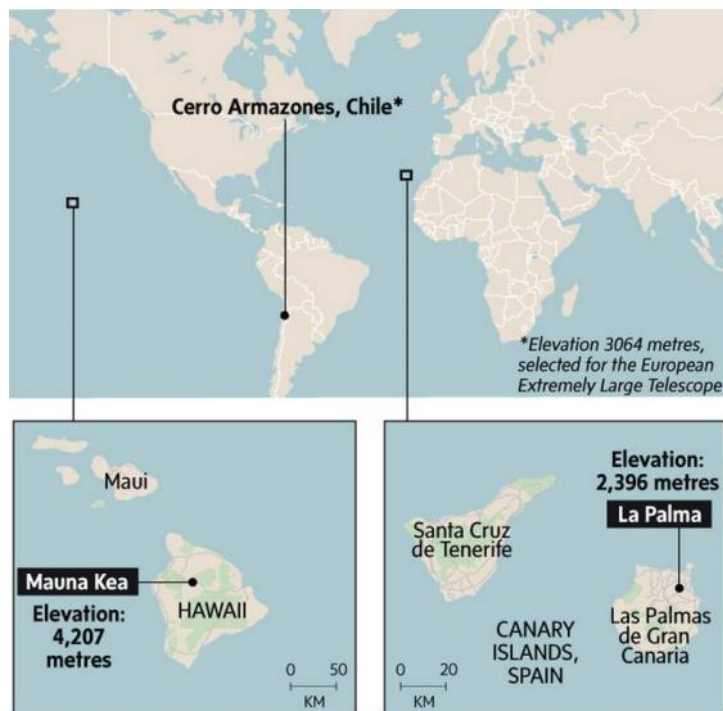
Last fall, the group selected a site at La Palma, one of the Canary Islands, as a backup in case the situation in Hawaii cannot be resolved in time. La Palma, which belongs to Spain, hosts other observatories and would welcome a major international research facility. On Wednesday, TMT executive director Ed Stone announced the group had signed an agreement with the institute that oversees the La Palma site, which ensures that there will be a place to build TMT “should Mauna Kea not be feasible.”

This has dismayed Dr. Carlberg and some other long-time Canadian advocates of the project – for the simple reason that the peak of La Palma is 1,800 metres lower than Mauna Kea. The difference amounts to a significantly thicker layer of air and turbulence between the telescope and some of the faintest and most distant objects in the universe. Additional worries have been raised about dust blowing in from the Sahara. The air over La Palma also holds more moisture, which blocks light in the mid-infrared part of the spectrum, where certain astrophysical targets, including the atmospheres of Earth-like planets, are best observed.

These are serious downsides, Dr. Carlberg says, particularly if it means that TMT is less likely to attract the additional partners it needs in order to be fully funded. If TMT goes to La Palma, he says, Canada should consider jumping ship. But while everyone agrees that Mauna Kea is the better place for TMT, many do not share Dr. Carlberg’s dismal assessment of La Palma.

“It turns out to be a really excellent secondary site in many respects,” said Doug Welch, a McMaster University astronomer who replaced Dr. Carlberg on the TMT board.

According to Dr. Welch, the technical stats on La Palma’s viewing conditions are far better than its detractors suggest. On average, dust levels compare favourably with Mauna Kea, and the stability of the air flowing above the site makes it well suited to the TMT’s adaptive optics – a technology that astronomers use to cancel out the effects of air turbulence on coming starlight.



TRISH McALASTER / THE GLOBE AND MAIL

Even the mid-infrared work can be achieved, Dr. Welch said, with protocols in place to prioritize those kinds of observations when conditions are just right.

U.S. astronomer Charles Telesco of the University of Florida has been observing at precisely those wavelengths for many years, both at La Palma and Mauna Kea. While the Hawaiian site is generally preferred, he said, “If TMT cannot be sited on Mauna Kea, then, in my opinion, La Palma is a reasonable alternative.”

But the debate among Canadian astronomers is not just about how La Palma compares with Mauna Kea. More to the point is how it will stack up against its chief competitor, the European Extremely Large Telescope (EELT), now being built on a high, dry mountain top in Chile.

From the outset, TMT was always going to be a bit smaller than the European scope. As its name suggests, its vast primary mirror will measure thirty metres across, compared to the EELT’s even larger 39.3-metre aperture. But TMT’s participants have always maintained that theirs will have superior technical performance, making it equal or superior to the European scope.



Dr. Carlberg said this equation no longer holds at La Palma. If TMT ends up going to the Canary Islands, then the bottom line is that Europe will have “a bigger telescope on a higher, better mountain,” leaving Canada as part of an astronomical also-ran.

Instead of settling for La Palma, Dr. Carlberg says Canadian astronomers should be ready to make a pitch to join the European telescope. Canadian astronomers discussed the European option years ago but ultimately chose TMT, in part because joining with Europe’s astronomy enterprise would require the Canadian government to pass a treaty in Parliament, an even higher political hurdle than it took to get TMT approved. And it’s not clear at this stage whether Europe needs Canada as part of its telescope – at least not the way TMT needs Canada, including the Canadian dome and optical systems.

In January, University of Waterloo astrophysicist Michael Balogh was tasked with chairing a committee to address questions about the TMT project and the La Palma site on behalf of professional astronomers across Canada. The committee is now holding web seminars to inform the community on various technical details.

“If we have to go to the alternate site then we need to understand what the impact will be on the science performance of TMT,” Dr. Balogh said.

In the coming months, the committee will issue a report that will be taken on board as a recommendation from the community to help steer Canada’s long-term goals in astronomy.

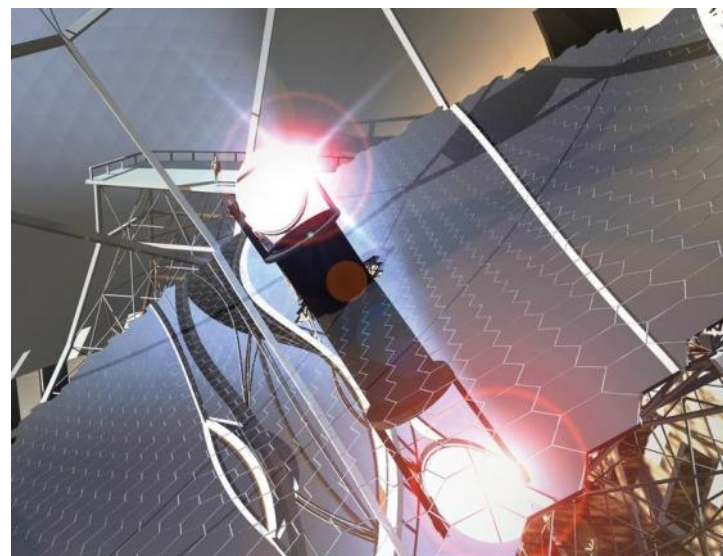
Meanwhile, Canada’s rank-and-file astronomers who are hoping to some day make discoveries using TMT are wondering how it will all play out. Many expressed mixed feelings.

Kim Venn, an astronomer at the University of Victoria, said that, for her part, TMT at La Palma would perform well for the kind of research she does on metal-poor stars. But she also wonders what other big and possibly unforeseen discoveries might be precluded if the giant telescope ends up there.

Asked what outcome she is wishing for, Dr. Venn paused and said, “I wish for TMT on Mauna Kea – period.”

Picture 1 A laser on the Thirty Meter Telescope will help the observatory take space-quality images.

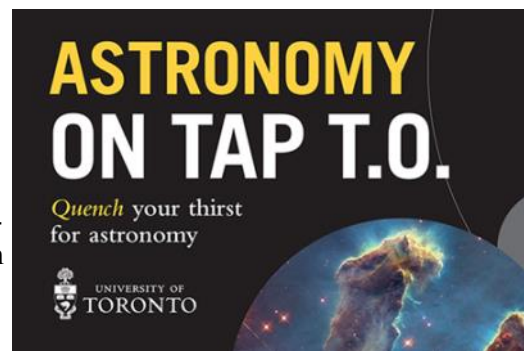
Picture 2 A 2004 artist’s concept of the Thirty Meter Telescope. Todd Mason/Thirty Meter Telescope Project



Astronomy on TAP, by Ed Mizzi

On Friday evening, March 10, 2017, Hamilton Centre RASC members Ed Mizzi and Mark Smith made their way to the Grand Hall in Toronto, to attend the Astronomy on TAP event.

This event was hosted by the Dunlap Institute for Astronomy and Astrophysics, University of Toronto and the Graduate Astronomy Students Association (GASA). The MC was Dr. Michael Reid, who once visited the Hamilton Centre to give a talk.



He was very engaging and kept us laughing throughout the event. There were 3 speakers whose topics included Dark Matter, Star Formation (Radio Astronomy) and Cosmology and all were fascinating. In between speakers the organizing group engaged the audience in astronomy related trivia games, with prizes. The atmosphere was relaxed and attendees could sip on a cold beer or cocktail while listening to those on stage.

Astronomy on TAP is an ongoing program so watch for their next event. It's well worth the trip and the time.

Please see the 2 links below for more information, and sign up to receive information about future events, (under the Outreach tab).

A big thank you goes to Roger Hill for bringing this to our attention via the Forum.

<http://www.dunlap.utoronto.ca/>

<http://www.facebook.com/dunlapinstitute/>



Top Left: Dr. Rachel Friesen addresses the crowd; Top right: Dr. Tyler Natoli; Bottom left PHd student Jial Zhang. Bottom right: Prof. Mike Reid.

Hamilton Centre RASC, March 2, 2017: “Monthly Meeting” By Ed Mizzi

March Monthly Meeting Synopsis, by Ed Mizzi

Attendance was up for the March meeting, with 45 people present at the Legion Hall in Waterdown.

Gary Bennett opened the meeting with a warm welcome to both club members and members of the public. He also welcomed new members and discussed the agenda for the meeting.

He began his report by describing the RASC Certificate Program and announced the most recent winner in the Category of Astro Imaging Certificate: Wide Field. Scott Barrie was then called up to receive his award and was introduced to those in attendance. His photographs were displayed for the crowd, which was very impressed by what Scott had accomplished. Congratulations to Scott Barrie.

Gary Colwell was next with his regular “What’s up in the sky this month” (March 2017 Edition). Gary, with the help of slides he had produced, described a few of the special events that would occur in March. The most exciting event involved an occultation involving the Moon and Aldebaran. Gary invited Roger Hill to give more details about this event. Roger explained exactly what would occur and invited others to join him at a spot in Georgetown, where the best viewing of this event would occur. The excitement in Roger’s voice was palpable!

We then had a 15 minute break during which people could chat with fellow members and introduce themselves to others.

At this point in the evening, Gary Bennett introduced our special guest speaker, Dr. Niayesh Afshordi, who is a member of the Faculty of Science (Dept. of Physics and Astronomy) at the University of Waterloo. Dr. Afshordi’s presentation was entitled “What Banged and Why? The greatest detective story of all time!”

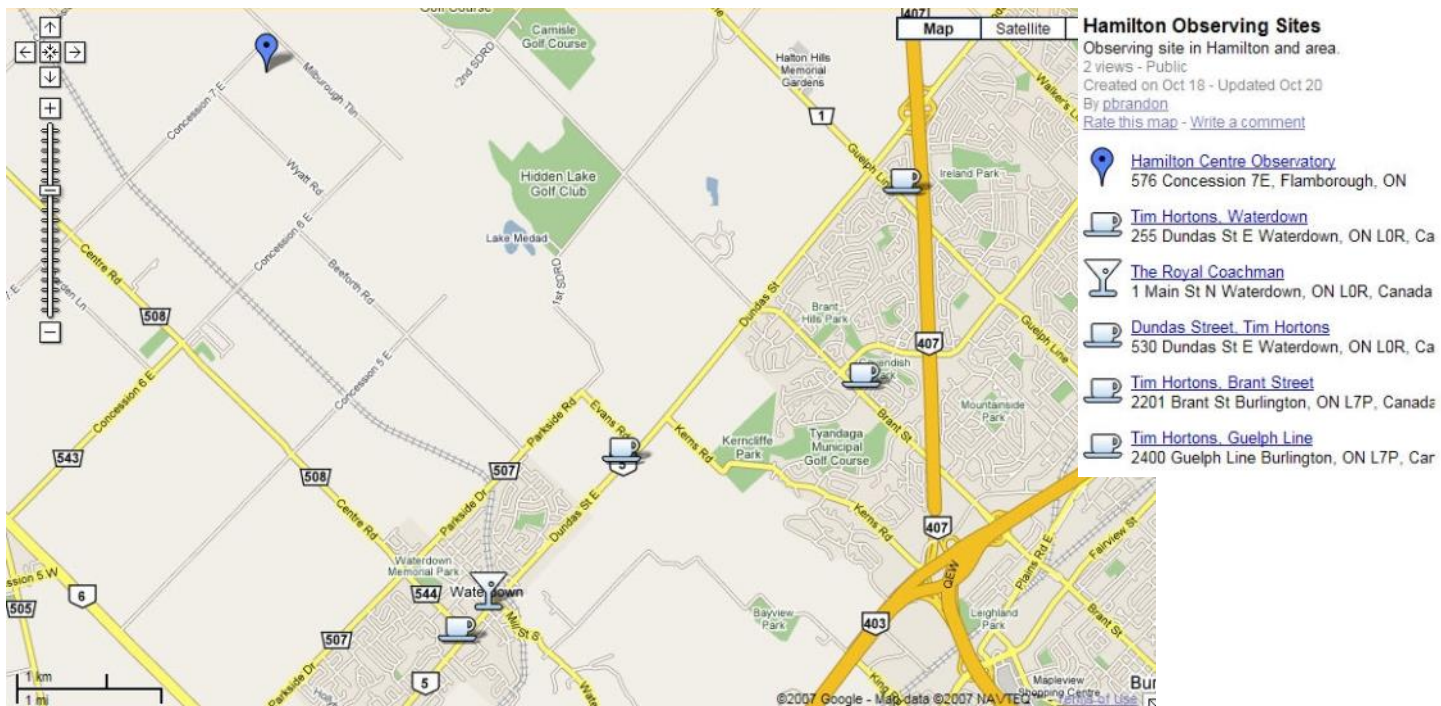
Dr. Afshordi provided us with a very enlightening talk about models and theories about the Big Bang and provided us with a variety of scenarios about how our Universe began. He left us with lots of “food for thought” and broadened our horizons about how things could have occurred. He also answered several inquisitive questions from the audience and offered to return to give other talks if asked.

The meeting was adjourned and several attendees met for further discussion at the local Royal Coachmen pub. The primary topic was the Solar Eclipse on August 21, 2017.



From Top Left (Clockwise) Gary Bennett; Gary Bennett and Scott Barrie; Roger and Gary Colwell; Dr. Niayesh Afshordi ; Gary Colwell





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Councillor	Dino diSabatino

These two pictures are from Gordon Haist in Oakville, and Wayne Herd in Guelph. Gordon's picture was taken a split second before the Moon passed in front of Aldebaran, and Wayne's was taken very shortly after the Moon had passed by. Gordon used an Olympus DSLR and a 300mm lens, whereas Wayne used a Canon 5DIII on a tripod 1/5 sec at f/20 and 240mm. Gordon stated that "All said, this was a very worthwhile event to observe and record."

