The High Desert Observer

November 2016

The Astronomical Society of Las Cruces (ASLC) is dedicated to expanding public awareness and understanding of the wonders of the universe. ASLC holds frequent observing sessions and star parties and provides opportunities to work on Society and public educational projects. Members receive the *High Desert Observer*, our monthly newsletter, plus membership to the Astronomical League, including their quarterly publication, *Reflector*, in digital or paper format.

Individual Dues are $30.00 per year

Family Dues are $36.00 per year

Student (full-time) Dues are $24.00

Annual dues are payable in January. Prorated dues are available for new members. Dues are payable to ASLC with an application form or note to: Treasurer ASLC, PO Box 921, Las Cruces, NM 88004. Contact our Treasurer, Patricia Conley (treasurer@aslc-nm.org) for further information.

ASLC members receive electronic delivery of the HDO and are entitled to a $5.00 (per year) Sky and Telescope *magazine discount.*

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ASLC Board of Directors, 2016

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November Meeting --

Our next meeting will be on ***Friday, November 18,*** at the Good Samaritan Society, Activities Room, starting at 7:00 p.m.

The speaker will be Dr. Penelope Boston, director of the Astro-Biology Institute, NASA Ames.

Member Info Changes

All members need to keep the Society informed of changes to their basic information, such as name, address, phone number, or emai address. Please contact Treasurer@aslc-nm.org and jkile3916@gmail.com with any updates.

Outreach

Outreach is a very important part of ASLC. We are always looking for more volunteers to help us educate the public. Even if you do not have a portable telescope to bring to the events, please consider attending our public outreach programs to help answer questions, share knowledge and point out constellations in the sky.

Events

ASLC hosts deep-sky viewing and imaging at our dark sky location in Upham. We also have public in-town observing sessions at both the International Delights Cafe (1245 El Paseo) and at Tombaugh Observatory (on the NMSU Campus). All sessions begin at dusk.

At our Leasburg Dam State Park Observatory, we hold monthly star parties. Located just 20 miles north of Las Cruces, our 16" Meade telescope is used to observe under rather dark skies. Please see *Calendar of Events* for specific dates and times.

Outreach Events For October 2016

by Jerry McMahan

Tombaugh Observatory Open House, Friday, October 7

Steve Shaffer and I attended. So did the clouds. No observing was done. Nancy Chanover did a slide show featuring current space missions so some thing was accomplished.

Moongaze, Saturday, October 8

Chuck Sterling called me a couple of hours after noon. He said it was raining and thundering at his house. It was doing the same at my house so we decided Moongaze was not going to happen. I looked out a couple of hours later, and it was partly clear with the Moon visible. I decided to load the ETX 125 into the car. I called Chuck back and he had decided to load his 10 inch. We took a chance, which paid off. It was not a great night, but the Moon was visible through thin clouds and was in the clear at times. Chuck had Saturn. Not bad for a night when it looked like we had no chance a few hours before. It was also good to have one couple stay all evening, obviously fascinated by what they were seeing.

It was also Astronomy Day, so we also had an event scheduled for Leasburg Dam State Park. I have not heard if they had any success at that location.

Home Schooled Group at Veterans Park, Tuesday, October 13

As usual this group provided a large turn out of students and parents, plus a few more people who happened to be in the park at the time. It was also clear so we had a lot of objects to view. Sid Webb set up his 10 inch goto Dobsonian. Tracy Stuart bought his 8 inch Meade. Chuck Sterling still had his 10 inch loaded in the car from Moongaze. I also still had the ETX 125 in the car.

We were still pointing the scopes, for the observers, three hours after staring time. It was a great night.

Leasburg, Saturday, October 22

Once again, it looked like Cloudsburg early on. We could see Venus, Saturn and Mars to get started with, but little else. Then it cleared and cleared rapidly, so we finished with a nearly cloudless night.

Bob Armstrong and Sid Webb were present as was Ed Montes. Daniel Giron opened the observatory. I never got over to the observatory to see what other scopes were set up. I will try to do a better job next time. Chuck Sterling and I were on the grass, near the parking lot. Chuck had his 10 inch and I set up my 8 inch.

We had many celestial objects to look at, but not many people to look. Daniel said he had only four people at the observatory and that is probably what we had on the grass. One man did stay the entire evening.

The clouds may have discouraged some of the regulars, but Daniel said that not many campers showed up, or were present for the music portion before the observing program. Maybe next time we will have clear skies and observers.

Tombaugh Observatory Open House, Friday, November 4

Steve Shaffer and I showed up, but the event was canceled for good reason. Venus, Mars and the Moon were visible, but so were clouds and lightning. The wind was also blowing hard. It started raining on my way home.

Tombaugh Family Reunion, Saturday, November 5

The event was held at the Tombaugh Observatory. Steve Shaffer operated the club's 12.5 inch scope. He may write up a report about the session. The weather was better than the previous night, so Steve did say that things went well.

Moongaze, Saturday, November 5

Chuck Sterling and his 10 inch joined me and the ETX 125. It was clear most of the evening. We didn't have a big crowd, but several people who looked through the scope returned later with their kids and spent most of the evening with us. The Moon, Mars and Venus were observed.

One man from El Paso had contacted Chuck about collimating his Newtonian. He bought the scope to Moongaze and Chuck performed a successful operation on it. Steve Shaffer put in a long day. He was at the Ren Fair in the afternoon, at Tombaugh Observatory, for the family reunion in the evening and then came to Moongaze after he finished up at the observatory. He was also at the Fair Friday and Sunday. Chuck was also at the park on Sunday. Hopefully some one will report on that event as well.

We finished Moongaze at about 10 PM. We were surprised to find that dew was on the scope tubes and eyepiece boxes. The temperature was 60 F, but the dew point had been reached.

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Calendar of Events (Mountain Time - 24 hr. clock)

Nov	04	18:14	OUTREACH; Tombaugh Observatory NMSU Campus
	05	09:00	OUTREACH; Renaissance Arts Fair:
	05	18:00	OUTREACH; MoonGaze, International Delights Café
	06	00:00	Daylight Saving Time Ends
	06	09:00	OUTREACH; Renaissance Arts Fair:
	07	12:51	First Quarter Moon
	10	18:00	OUTREACH; Desert Springs Christian Academy
	14	06:52	Full Moon: Super Moon, at closest perigee since 1948 -33.5 arcmin, mag -12.4
	18	19:00	ASLC Monthly Meeting; Good Samaritan Society Creative Arts Room
	19	18:00	Dark Sky Observing at Leesburg Dam State Park
	21	01:33	Last Quarter Moon
	24	00:00	Thankgiving - All Day
	29	05:18	New Moon
Dec	03	18:00	ASLC Christmas Party - Pot Luck: Contact Cristina Lugo for details.
	03	18:00	(4) Vesta Stationary.
	07	02:03	First Quarter Moon
	08	17:00	OUTREACH; Tombaugh Observatory NMSU Campus
	10	17:00	OUTREACH; MoonGaze, International Delights Café
	11	12:00	Mercury at greatest elongation E (21^{o})
	13	17:06	Full Moon
	14	00:00	Geminid meteors peak - The near Full Moon will deminish this event.
	15	14:00	(1) Ceres Stationary
	17	17:00	Dark Sky Observing at Leesburg Dam State Park
	20	18:56	Last Quarter Moon
	21	17:44	Winter Solstice
	23	19:00	NO ASLC Monthly Meeting for December
	25	00:00	Christmas - All Day
	28	23:53	New Moon
	29	23:00	Uranus Stationary

Be sure to visit our web site for the latest updates: *www.aslc-nm.org*

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Announcements

1. On Nov 13-14, 2016, prepare yourself for greater gravitational pull! The Moon is closer to Earth than it has been since 1948, and the next closer perigee will be in 2034. Because the Moon is so close, it will be bigger and brighter. Perhaps some of you Moon-phreks will get some photos for the next HDO!.

2. Your editor has decided NOT to publish an HDO in December this year. Because there is no December meeting, there are no minutes to be distributed, and everyone is busy with holiday activities. I hope some of you lucky folks who receive new toys for Christmas, like fancy cameras, new eyepieces, other new gadgets, and even new scopes will bring them to the January meeting to display at Show and Tell and make us all envious.

3. New Meeting Location: In August, we began holding our monthly meetings at the Good Samaratian Society Creative Arts Room. Check out the web site at *www.aslc-nm.org* for a map and directions. Basicly, from the old meeting location at DACC, go up University(East) and cross over I-25. Just past I-25, at the third light, turn left on South Telshore Blvd and go about 2 blocks to Buena Vida Cir and turn right. The meeting location is the second building on the right. Go inside and look for the Creative Arts Room and familiar faces.

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Meeting Minutes

by John McCullough

Show & Tell:

Roy Willoughby presented images of his JMI-18 telescope that he is selling; he is asking $5000. Members should contact him if they have questions or are interested in purchasing the telescope. He also had images of a fox that frequents his backyard.

Call to Order:

Daniel Giron, President, Astronomical Society of Las Cruces (ASLC, the Society), called the October 2016 business meeting to order at 7:30 pm, 28 October 2016, Creative Arts Room, Good Samaritan Society Las Cruces Village, 3011 Buena Vida Circle, Las Cruces, New Mexico.

President's Comments:

Daniel Giron, President, welcomed the group to tonight's meeting and emphasized that tonight is the Society's Annual Meeting as required by the By Laws. Election of officers for 2017 will be finalized tonight; if members need a ballot, blanks are available. Upon completion of vote tallying, Daniel announced the officers as follows:

President	Howard Brewington
Vice-President	Rich Richins
Treasurer	Patricia Conley
Secretary	John McCullough
Director-at-Large, #1	Sid Webb
Director-at-Large, #2	Ed Montes

Daniel congratulated the winners and thanked them for offering to serve as officers next year. He also thanked the Society members that served during 2016 as officers, particularly Cristina Lugo as Vice-President, committee chairs, and as Nominating and Election Committee members. He thanked members that had served in special functions and for supporting activities such as telescope making and astro-photography workshops.

Daniel reminded members that the 2016 Renaissance Arts Faire will be 04 06 November at Young Park. Volunteers are needed for setup on 04 November between 10:00 and 2:00, to operate the booth in costume on 05 06 November, and to tear-down after the Faire closes on 06 November.

This year's Holiday Party will be on 03 December at Cristina Lugo's home. It will be potluck; please contact her regarding what you will bring and for directions.

The last formal meeting of 2016 will be 18 November, one week earlier than usual due to the Thanksgiving Holiday. Dr. Penelope Boston, director of the Astro-Biology Institute, NASA Ames, will be the speaker.

Bert Stevens is ordering Royal Astronomical Society of Canada (RASC) Observer's Handbooks and calendars. Those interested should sign-up on the sheet circulating at tonight's meeting. Daniel also recognized Bert's astronomy column that has been appearing in the Las Cruces Sun News for the last eighteen months and the excellent exposure it has given astronomy in general and the Society specifically.

Finally, Daniel asked that all members and guests register their attendance on the sheets that are available at the back of the room.

Special Presentation:

Daniel recognized some special guests present at tonight's meeting: Clyde and Patricia Tombaugh's children, Annette Tombaugh Sitze and Alden Tombaugh; and Walter and Beryl Haas' daughter, Mary Alba.

Annette offered recollections of her parents coming to Las Cruces at the instigation of her uncle, James Edson, and eventually founding the Astronomical Society of Las Cruces on 06 October 1951 along with Bill Brown, Walter Haas, and Jed Durrenberger. Annette was even Society Secretary for a time.

Alden followed with his memories of that time although he is Annette's younger sibling and was more interested in rocketry than astronomy.

Mary also offered her remembrances of the early Society meetings when they were held in members' homes. Annette closed by noting there will be a special event, a Tombaugh family reunion, at the Tombaugh Observatory on the New Mexico State University campus on 05 November at 7:45 pm.

Presentation:

This month's presentation was by Bill Godby, one of three archaeologists at White Sands Missile Range (WSMR) that manage over 8000 historic sites. His topic was "Tracking Telescopes and the Forgotten Legacy of Clyde Tombaugh at White Sands Missile Range" covering the development of tracking telescopes and Clyde's pioneering work at WSMR. Bill discussed Clyde's role in the development of a system called Bright Eyes, the first tracking telescope at WSMR and its subsequent evolutions. He also talked about the T 4 telescope located at the Mule Peak site in the Lincoln National Forest that is slated for demolition. The Telescope 4 or T 4, also known as Popeye (but for unknown reasons), is mounted on a 90mm gun carriage and equipped with a 35mm Mitchell camera. The telescope is still intact at Mule Peak and was identified as WSMR's most powerful telescope in the 1950's. Bill discussed Clyde's involvement with the T 4 starting in 1948 and present efforts to return the telescope to the WSMR Museum. Bill's plans for the future include a display highlighting Clyde's work at WSMR to complement his team's recently completed first of its kind interactive display that presents the early development of tracking telescopes and cinetheodolites at WSMR and how they worked.

The October meeting of the Astronomical Society of Las Cruces concluded at 8:56 pm.

-Respectfully submitted by John McCullough, ASLC Secretary

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Back at the Telescope

by Bert Stevens

Real space travel depends on finding a more efficient way of getting into space. Our chemical rockets are mostly fuel, with a small payload at the top. If you remember the Saturn V launches, the rocket would leave the pad very slowly. As it consumed fuel and became lighter, the constant thrust of the engines would accelerate it faster and faster. As the fuel was consumed, the weight of the fuel tanks and big engines soon became just excess weight.

To eliminate the weight of the empty fuel tanks and big engines, rockets are designed to drop the excess weight into the ocean when it no longer contributes to the flight. This is called staging, when the empty first-stage fuel tanks and engines are separated from the rest of the rocket by explosive charges. The smaller and fewer engines in the second stage take over and continue to push the payload into space. Depending on the mission, there could be a third, and even a fourth stage. Over ninety percent of the rocket's weight at lift-off is engines and fuel.

When you watch a rocket flight, the rocket lifts-off vertically and very quickly starts to tip over along the line of flight. Within the first few minutes, the rocket is flying almost horizontally. Most of the energy of the rocket is used to push it faster horizontally, that lift it vertically. The main reason for the vertical take-off is to get the rocket out of the thickest part of the atmosphere as quickly as possible. It would take even more fuel to fight the additional aerodynamic drag that a horizontal launch would encounter.

The function of the rocket launch is to get the horizontal velocity to stay in orbit. The faster you can get to orbital velocity, the less fuel you have to burn to keep the rocket from falling back to Earth. This means that the more acceleration that the rocket has, the more efficient it can be. No matter how efficient the rocket, it still has to burn a tremendous amount of fuel to reach orbit.

Figure 1: Lift-off. *The Apollo 11 Saturn V rocket lifts off from Cape Kennedy on July 16, 1968. This was the largest operational rocket in the world at the time.*

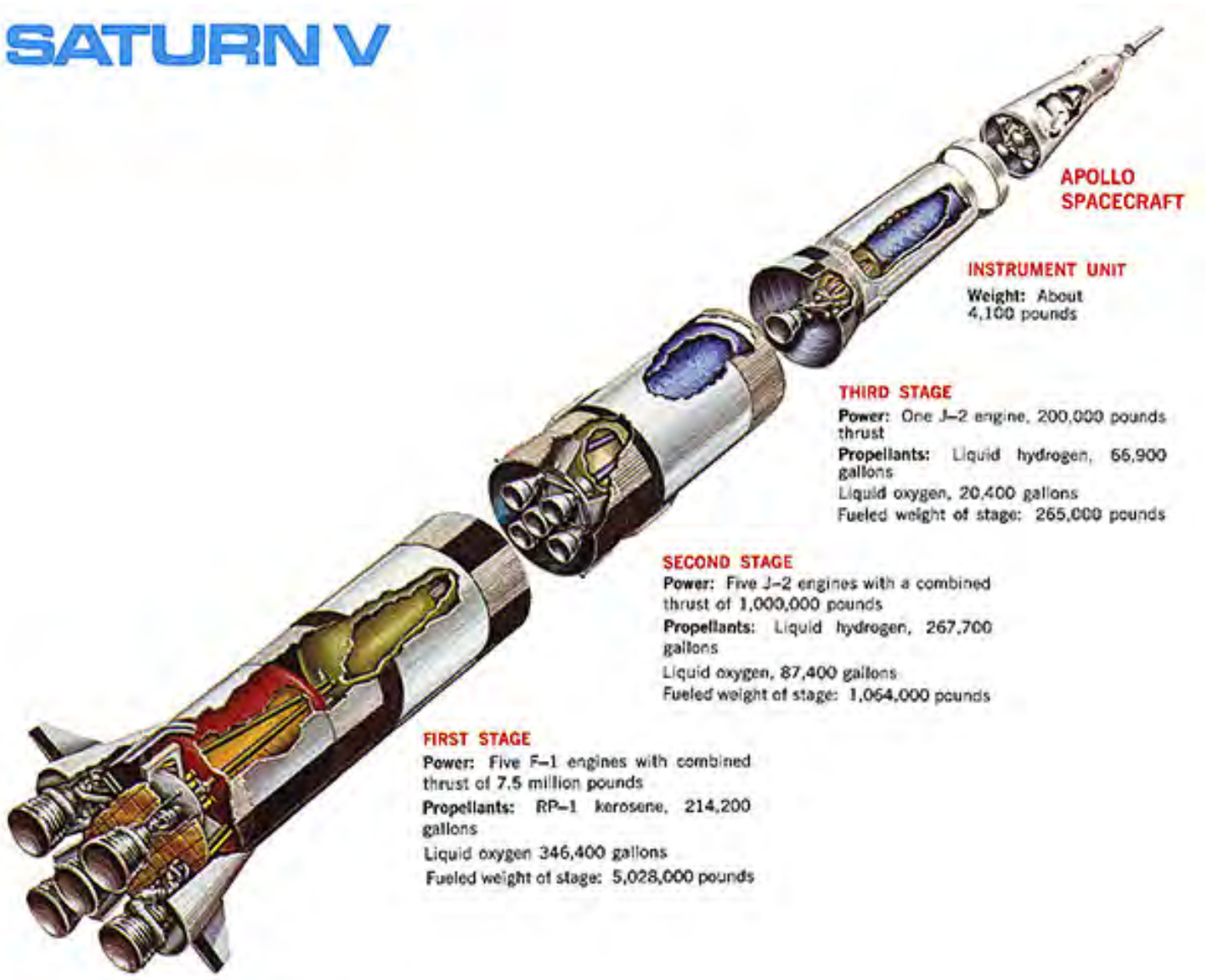

Figure 2: Saturn V Cut-away. *A rocket like the Saturn V is divided into multiple stages. Each stage accelerated the payload to a higher speed before it is dropped to fall into the ocean. Only the top stage is traveling fast enough to make orbit.*

In trying to determine a more efficient system of getting spacecraft into orbit, engineers have looked at the mass driver. The mass driver is a series of electromagnets (typically arranged as a series of rings) that are activated in sequence. A magnetic spacecraft is placed at the start of the mass driver. The first electromagnet starts pulling the spacecraft down the mass driver toward the first ring. After the spacecraft passes the first electromagnetic ring, it is turned off and the next one in sequence is turned on, accelerating the spacecraft toward it. Each electromagnetic ring pulls the spacecraft faster, until it has reached the desired velocity.

Using a mass driver eliminates multiple stages and most of the fuel. The reason this does not work on Earth is the same reason that a missile is launched straight up. A mass driver is still operating in our atmosphere and atmospheric drag will keep the spacecraft from reaching the speed needed. A mass driver works great on an airless body like the Moon. Robert Heinlein's book ***The Moon is a Harsh Mistress*** makes extensive use of mass drivers, which they called catapults.

One concept used in a different Heinlein book was to run the mass driver up the side of a mountain. This would reduce drag just at the time the spacecraft was travelling the fastest. Nevertheless, the highest peaks are still in a substantial amount of atmosphere and would still not be effective enough to be a successful launch mode. If a tube could be built up into space that would have all the air evacuated out of it, this might make the mass driver workable, but such a structure is not possible with current technology.

We can combine the mass driver and the rocket into a hybrid system by using a rocket to get the spacecraft out of the atmosphere to the entrance of a mass driver. The mass driver provides all of the horizontal speed necessary to send the spacecraft on its way. Power for the mass driver could be provided by solar panels. This sounds like a good idea, since it takes much less fuel just to lift a spacecraft to a high enough altitude for a mass drive to pick it up than it would to accelerate the spacecraft to orbital velocity with a rocket.

In this scenario, when the rocket lifts the spacecraft to the orbital altitude of the first electromagnetic ring, the magnetic field of first ring pulls the spacecraft toward it. It then follows the progression through all the rings until it reaches the desired velocity.

This sounds like a great way to get to orbit, but let us investigate the physics of the plan. First, the rings must maintain the correct position relative to each other. On Earth, the rings would be on mounts that would keep them carefully aligned. In space, each would be in an independent orbit, affected by the

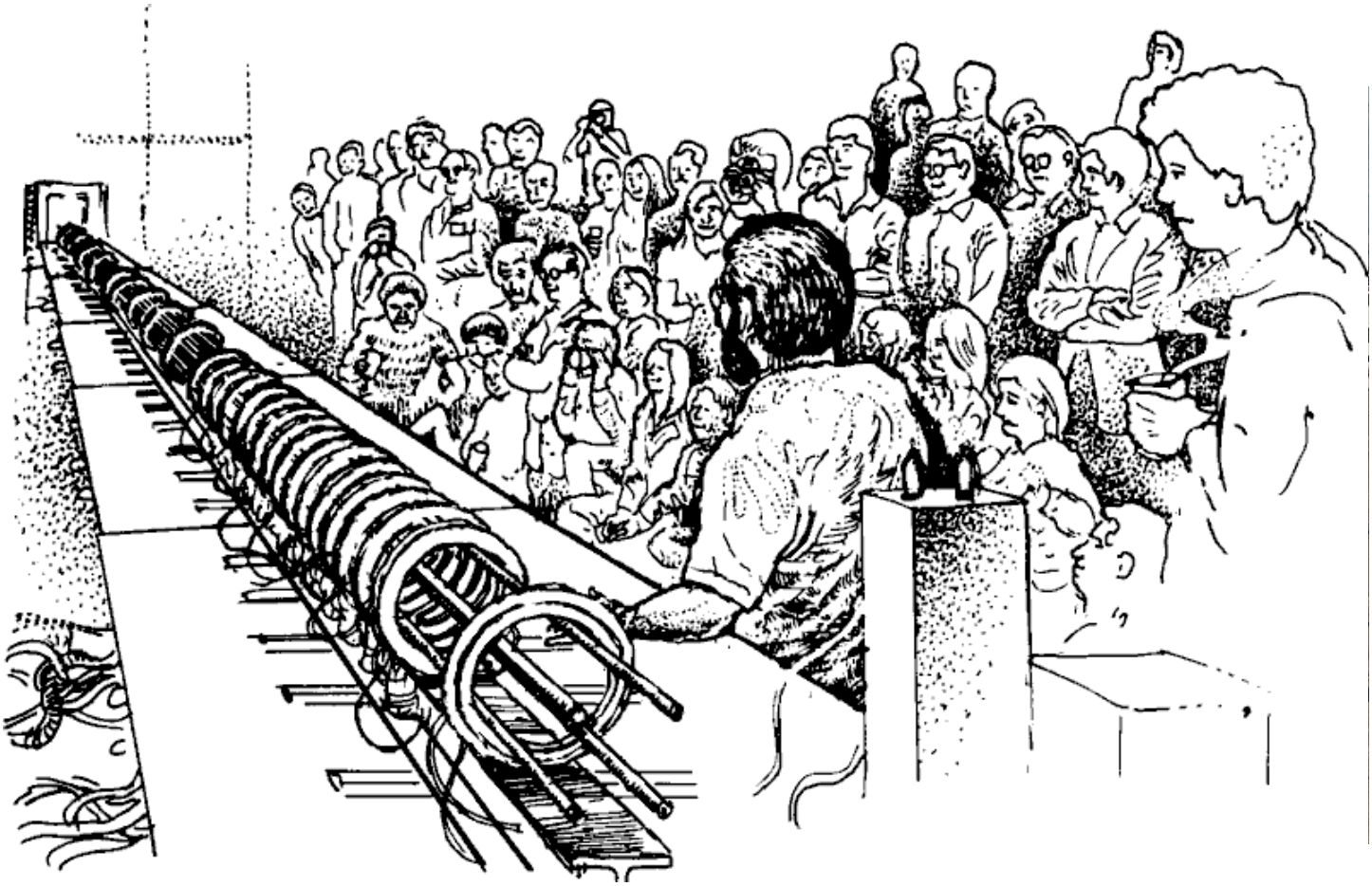

Figure 3: Mass Driver Concept. *Don Davis's drawing of an experimental mass driver. The test mass is propelled down the track by the magnetic fields generated by the ring electromagnets. The electromagnets are controlled by a computer program that monitors the motion of the mass down the track and turns the electromagnets on and off as needed. Copyright Don Davis.*

slight changes in Earth's extended atmosphere, outgassing from the ring itself, and the gravitational forces perturbing the orbits. Each ring would need to have thrusters to keep them in the correct position.

In addition, the rings would need to be in the same orbit. If they were in even slightly different orbits, it would be impossible to maintain the proper alignment. Different orbits would be the result of the rings being at different altitudes, giving each of them different orbital periods. The lowest ring would be traveling fastest and take the shortest time to orbit the Earth. Each higher ring would take a little longer to orbit the Earth and would fall behind the lower ones. This would make it impossible to hold the rings in alignment.

If the rings were assembled into a single structure, they would orbit together. This would keep them in alignment as they orbited the Earth. The orbit of the mass driver structure would be controlled by its center of mass. The individual rings would no longer be in independent orbits, but they would orbit together, staying in alignment.

However, Sir Isaac Newton is not done with this concept. The magnetic field of the ring structure will pull the spacecraft toward it. The conservation of momentum requires that the total momentum of a system cannot change unless acted on by an outside force. Momentum is measured as the product of mass times velocity. Since velocity is a vector quantity, it has a direction-specific component. This means that momentum is not only mass and speed related, but also direction related. The magnetic field of the mass driver in not external and as the spacecraft is accelerated toward the rings, the rings accelerate toward the spacecraft. There is nothing holding the rings in place.

Even as the momentum of the spacecraft increases, the momentum of the mass driver decreases to conserve the total momentum. This thrusts the rings backward as the spacecraft accelerates forward. While the spacecraft would reach orbital velocity, the rings would slow down so much that they would fall out of orbit and reenter the atmosphere. A single-use mass driver is, shall we say, ineffective and inefficient.

Why does a mass driver work so well on the Moon? The spacecraft would still be thrust forward, but now the total system whose momentum would need to be conserved includes the total mass of the Moon. The spacecraft would "steal" momentum from the Moon as it speeds down the mass driver. This is similar to a gravitational assist (sometime mistakenly called a slingshot) maneuver used by many spacecraft to increase their speed and change their orbit.

In both cases, the spacecraft gains momentum while the celestial body loses the same amount of momentum. Since the mass of the spacecraft is so small relative to the celestial body, the momentum transfer has a much greater effect on the velocity of the spacecraft than on the velocity of the hugely more massive celestial body.

In theory, if enough spacecraft flew by a planet, they could steal so much momentum that the planet would fall into the Sun. The same is true for a mass driver on the Moon. The total mass of all the spacecraft launched by the mass driver would need to approach the mass of the Moon itself. So if we ever establish a Moon base that used a mass driver, you do not need to worry about the Moon crashing down on us from launching too many spacecraft. You can just admire the efficiency of the system and hope that someday we can invent a process to send spacecraft into deep space from Earth without using rockets.

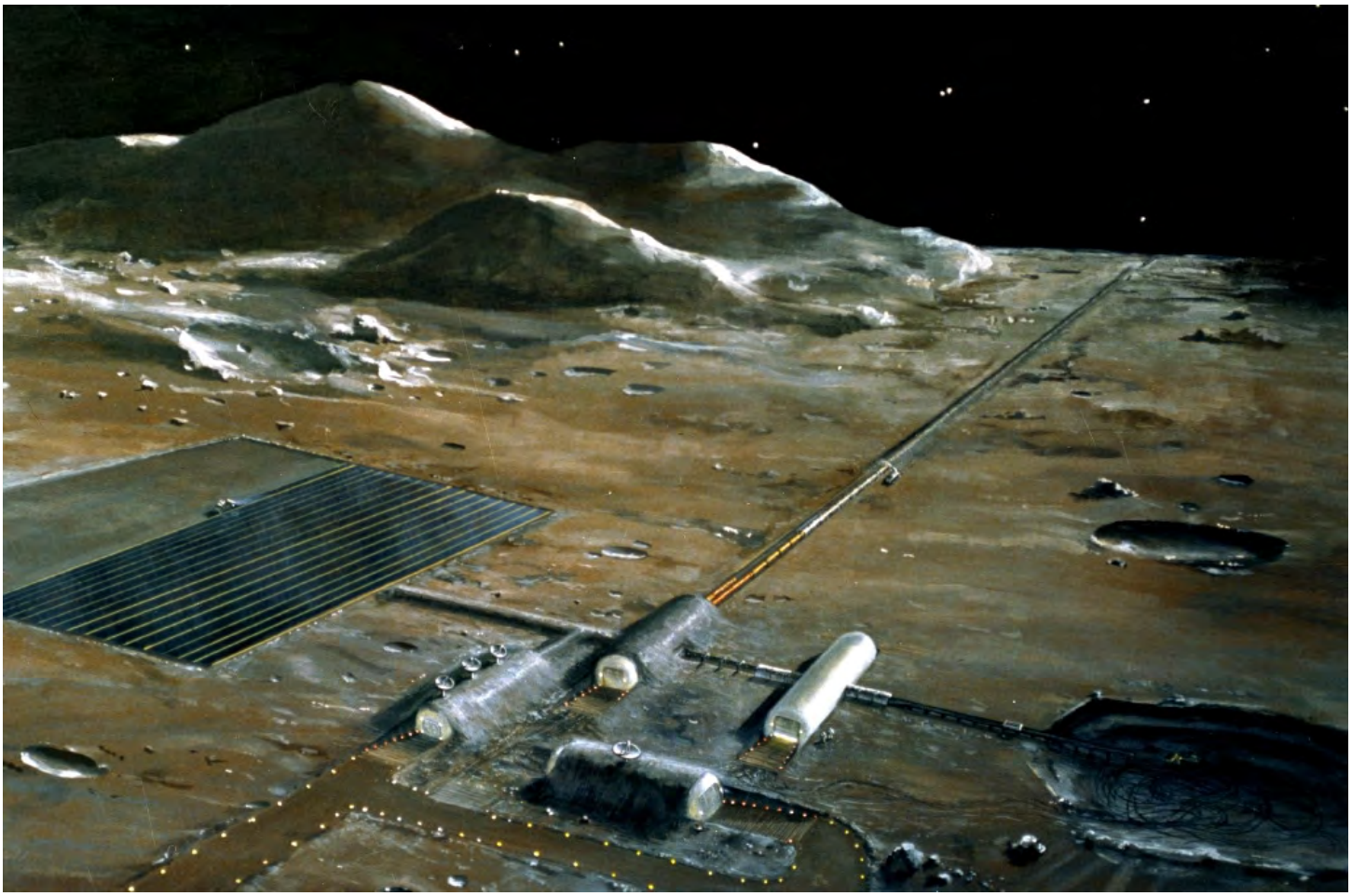

Figure 4: Lunar Mass Driver Concept. *The Moon is a perfect place for a mass driver. With no air to impede the spacecraft, the mass driver can launch spacecraft into an Earth-return orbit or toward another planet. A mass driver uses so much energy that the necessary power would have to be stored over time in capacitor banks. These could then be drained quickly to power the electromagnets in the mass driver.*

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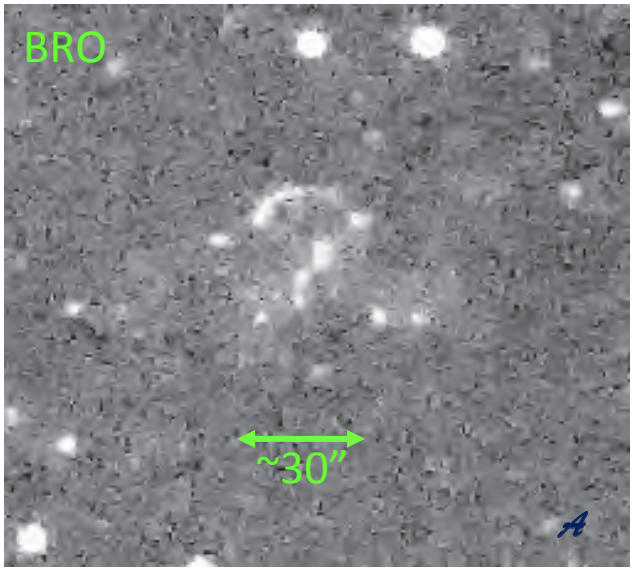
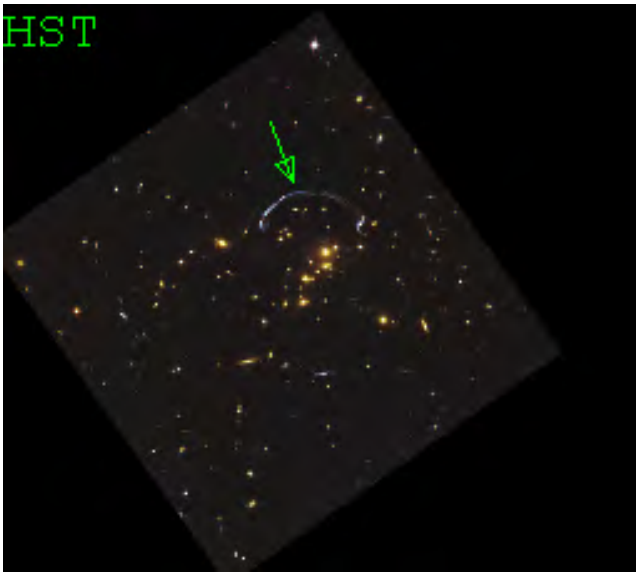
Gravity Lensing caused by Galaxy Cluster RCS2 032727-132623 (Alex Woronow)





Alex Woronow compares an image that he obtained with an image from the HST of the same area. Both images show some signs of gravitational lensing. Look at the objects pointed out by the arrows.

Using iTelescope T32, a 17” Planewave in Sliding Spring, AU, I got this image of the gravity lens associated with the galaxy cluster RCS2 032727-132623 (25x600” exposures). This is the brightest gravity-lens effect known (~17 mag) and is about 30” across. It is pretty much a small smudge on the 40’-across frames.

All processing was done in PixInsight, including some heavy-duty deconvolution and processing the image detail after inverting the image (i.e., as a negative image) and sacrificing the stars’ quality for more clarity of the gravity lensing.

A fade-in/out animation between these two images is available here:
https://dl.dropboxusercontent.com/u/27145780/GravityLensAnimated_RCS2-032727-132623.gif

Photo of This Month

Sculptor Galaxy and NGC 288:

The image was acquired through Kirby's old Stellarview 115mm fluorite triplet using an Atik 460 mono for luminance. I took a series of 10-minute subs (-10C) of the galaxy and of the globular cluster.

Those images were used/combined (as luminance channels) with a DSLR (Canon T2i) color image acquired through an Orion ED80 (3.5 minute subs @ ISO 1600). Processing was done with Nebulosity and Photoshop.

Image by Rich Richins from Cosmic Campground in Late October 2016.