

Sky WAA tch



The Outer Limits

Olivier Prache captured this image of NGC 891, a beautiful edge-on spiral galaxy in Andromeda. The galaxy is also known as the Outer Limits Galaxy because it was featured in the credits of the classic 1960s television series of the same name. Olivier took this photo over two weeks with a Hyperion 12.5" astrograph and ML16803 camera (a four-hour exposure processed with Pix-Insight).

Discovered by Caroline Herschel, NGC 891 is similar in size to our Milky Way. Like other spirals, NGC 891 rotates too fast to be explained by the mass of its visible stars, gas and dust. Dark matter has been hypothesized as a source for the missing mass.

In This Issue . . .

pg. 2	Events For December
pg. 3	Almanac
pg. 4	Highlights for 2016
pg. 5	The Astronomer at the Movies: The Martian
pg. 11	Outreach at Somers Library
pg. 11	Astrophotos
pg. 14	Our Solar System Is <i>Almost</i> Normal, But Not Quite

WAA December Lecture and Annual Meeting

“The New Horizons Mission”

Friday December 4th, 7:30pm

Miller Lecture Hall,

Pace University, Pleasantville, NY

Mr. Andy Poniros will speak on the New Horizons mission to the outer solar system. His presentation will include Clyde Tombaugh's discovery of Pluto, the history of planetary and Kuiper Belt discoveries, the New Horizons spacecraft and the Pluto flyby event.

Andy Poniros is a NASA/JPL Solar System Ambassador. He has a degree in Electrical Engineering and is a science reporter for a local Connecticut radio station. He produces astronomy and space mission radio shows and podcasts, is an amateur astronomer and telescope maker, and is a member of The Astronomical Society of New Haven. Free and open to the public. [Directions](#) and [Map](#).

A brief annual meeting will be held before the lecture (election of officers and a membership report).

Upcoming Lectures

Pace University, Pleasantville, NY

Our speaker for January 8th will be Charles Fulco. He will be presenting on light pollution.

Starway to Heaven

**Ward Pound Ridge Reservation,
Cross River, NY**

There will be no Starway to Heaven observing dates for December, January or February. Monthly observing sessions will recommence in March 2015.

In Memoriam

We are sad to report that Vivian Towers, a long-time WAA member and the wife of WAA member Doug Towers, passed away on Sunday November 22nd at age 80. Doug and Vivian were married for 52 years and lived in Yonkers. The officers and members of the Westchester Amateur Astronomers extend our deepest condolences to Doug Towers and his family.

Call: 1-877-456-5778 (toll free) for announcements, weather cancellations, or questions. Also, don't forget to visit the [WAA website](#).

New Members. . .

Nathaniel Borgelt - Bronxville
Steven Fennell - New Rochelle
Oliver E. Wayne - Cliffside Park
Joseph Hard - Garrison

Renewing Members. . .

James Frost - Rye Brook
Steve Petersen - Briarcliff Manor
Robert Rehrey - Yonkers
Al Forman - Croton-on-Hudson
Warren Lindholm - Cortlandt Manor
Sharon and Steve Gould - White Plains
Hans Minnich - Bronx
Elizabeth Scott - Bronx
Elaine Miller - Pound Ridge



Courtesy of Jim Haklar is this composite photo of the International Space Station crossing the Sun (the line of that looks like the letter "I"). Jim used a hydrogen alpha filter.

WAA Apparel

Charlie Gibson will be bringing WAA apparel for sale to WAA meetings. Items include:

- Hat (\$15)
- Polos (\$15)
- Tee shirts (\$12)



Almanac

For December 2015 by Bob Kelly

On the weekend mornings of Friday December 4th through Monday the 7th, the Moon climbs down the ladder of planets in the eastern sky before dawn. The role of the rungs is played by Jupiter, Mars and Venus, in that order. The bottom step is a doozy, with the Moon covering Venus. That happens in the afternoon of the 7th. Even if you don't find the pale Moon in the southwestern part of the hazy midday sky, it's worth getting out early in the cold dawn for the earthshine luster on the crescent Moon as it approaches Venus, with Mars and Jupiter shining above. Comet Catalina C/2013 US10 will be in the background near Venus. More on Catalina further ahead, after the breaking story of the Moon running over Venus.

To find the scene of the accident in the afternoon of the 7th, look to the right of the Sun – about 40 degrees to the right (four fist widths) at the altitude of the Sun in the sky. Block out the Sun and use binoculars to scan for Venus. Since the Moon is so thin and Venus has more surface brightness, you are likely to find Venus first, if at all. The times for the occultation of Venus are a 12:40 pm disappearance (approximately) behind the Moon's brighter limb and reappearance about 1:45pm from behind the Moon's dark limb. You might want to try getting out in the mid-morning, when Venus is highest in the sky, about 9am and look for the star-crossing pair almost 40 degrees above the horizon. Block the Sun and use binoculars. It'll be a great sight all day, with the possibility of finding the top three ranked objects (by brightness) in the daylight sky.

How bright will Comet Catalina C/2013 US10 get? After photo-bombing Venus around the 7th, Catalina gets higher in the morning sky each week, heading toward for a New Year's morning party with Arcturus. Use binoculars. The best days to look are those without much moonshine; December 8–20, and mid-January. The comet is forecast to peak about magnitude +5 as Catalina glides by Earth 67 million miles away on January 12th - not very close!

Need a gift idea for the holiday? Give Mercury, the elusive innermost planet, for the New Year! A true outside-the-box idea, Mercury gets almost a fist-high above the horizon in mid-twilight during the evenings of the last week of December and first week of January. Mercury trails the Sun in our sky if you want to



Dec 3



Dec 11



Dec 18



Dec 25

catch the 7 arc-second-wide planet in its half-lit phase during daytime.

The Full Moon will light up Christmas Eve, fullest just before sunrise on the 25th while setting just outside your west-northwest window. In the evening sky in the west, the Coat-hanger cluster does an impression of a Chanukah Menorah - only six lights in the row, but with a convenient carrying handle. Use binoculars to find it between Altair and Vega.

The Geminid meteor shower gets virtually moon-less skies this year. The peak is during daylight, but that means the nights of the 13-14 and 14-15 on either side of the peak are equally good. The show gets better as the night goes on and Gemini gets higher in the sky, but any time after dark is good. You could see a dozen or more bright meteors an hour. Get a wide view of the sky in a place where bright lights are out of sight.

If you haven't already, get your telescope to a place with an open southwestern sky for Uranus and Neptune. Ask folks who saw them at the November star party! Directions from a helpful star chart marking the location of the ice giants are essential as they are magnitude +5.8 and +7.9, respectively. If you want to catch the seven brightest planets in our skies, you'll have to dig Saturn out of the haze, very low in the dawn sky, even then, only late in December.

Jupiter rises near midnight and stays up the rest of the night, large enough and high enough to watch its moons dance and maybe even discern the Great Red Spot in your telescope. The GRS is visible every ten hours, about four hours earlier each night. Get thyself to an Internet and find the best times to see it and let us know if it's impressive (or pale).

The November 1st end of the Daylight Time offset really hit me hard this year, with the sudden darkness every evening. But we have hope! Sunset starts moving later starting around the 6th, with the Sun setting five minutes later by Christmas. In that same time period, Sunrise moves ten minutes later, giving you every chance to get up and out to see the pre-dawn sky. This all averages out to the longest night of the year (for the northern hemisphere) on the 21st – 22nd, with the moment of solstice at 11:48pm on the 21st.

The International Space Station soars over us with six souls on board, is lit up in the evening sky in December just after dark through the 25th.

Highlights for 2016

Bob Kelly

Five eclipses: Two of the Sun and three of the Moon; none of significance for our area.

All of the lunar eclipses are penumbral, that is, none of the Moon will be in dark shadow.

The next total lunar eclipse for our area will be in January 2019.

The next solar eclipse of consequence for our area will be August 21, 2017, with a total eclipse from Oregon to Tennessee to South Carolina. Three-quarters of the Sun's diameter will be covered for NYC.

The marquee event of 2016: will be the Transit of Mercury across the Sun on Monday, May 9th.

For seven and a half hours Mercury will be in front of the Sun, all visible from our area. Make sure your properly filtered telescope is ready!

Other events:

- **January 9**, Venus and Saturn very close, 0.9 degrees apart, at dawn
- **January 19** Aldebaran occulted by the Moon around 9-10pm
- **February 6, 7**, Venus and Mercury near the Moon after dawn
- **March 8**, Jupiter at opposition; 43.7 arc-second wide
- **March 29**, Mars and Saturn near the Moon in the pre-dawn sky
- **April 10**, Aldebaran occulted by the Moon – daytime 6-7 pm
- **Mid-April**; best viewing of Mercury in the dusk sky
- **April 24-25**, Mars and Saturn near Moon in the midnight to morning sky
- **May 9**, Transit of Mercury
- **May 22**, Mars at opposition, closest approach on the 30th; 18.5 arc seconds wide
- **June 3**, Saturn at opposition; 18.4 arc seconds wide (not counting the rings)
- **July 22/23** Neptune occulted by the Moon around midnight. Mag 4 star in Aquarius very nearby.
- **July 29**, Aldebaran occulted by the Moon at sunrise
- **August 4**, Jupiter, Mercury, Venus near Moon, low in the west at sunset
- **August 24**, Venus and Jupiter 0.1 degree apart, very low at sunset
- **September 2**, Neptune at opposition; 2.3 arc-seconds wide

• **Late Sept/Early Oct**, best viewing of Mercury in the dawn sky. Moon and Mercury rise together at dawn on the 29th.

• **October 15**, Uranus at opposition; 3.7 arc seconds wide

• **November 2**, Saturn and Venus near Moon in dusk sky.

• **December 6**, Neptune occulted by the Moon, hard to see in bright twilight

• **December 12**, Aldebaran occulted by the full Moon about 10:30pm

• **Venus** is in the morning sky from the start of the year through April and the evening sky from mid-July through the end of the year. Jupiter is well up in our skies around opposition. Saturn and Mars are low in the sky this year.

Other Dates:

2016 is a leap year.

Easter is March 27.

Ramadan begins at the first sighting of the moon after the June 4th new moon.

Islamic New Year 1438 begins at the first sighting of the moon after the September 30th new moon.

Jewish New Year 5777 begins at sundown Oct 2.

Most Significant Meteor Showers in 2016:

Information from American Meteor Society.

Quadrantids peak Jan 3-4 Last quarter moon in morning skies.

Perseids peak Aug 12-13 $\frac{3}{4}$ moon in evening skies.

Leonids peak Nov 17-18 $\frac{3}{4}$ moon midnight through dawn.

Geminids peak Dec 13-14 Full moon all night.

(Data from the US/UK Astronomical Almanac from the [USNO website](http://www.usno.navy.mil/USNO). Occultation information is for our location in the northeastern USA, checked with Mobile Observatory program for Android.)



The Astronomer at the Movies: The Martian

Larry Faltz



At the conclusion of Ray Bradbury's novel *The Martian Chronicles*, the Martian race had been wiped out by the invasion of Earthlings, leaving behind only ruins of its civilization. By the end of the novel only a few human settlers remain on the planet. Asked by his son, "Where are the Martians?" a father takes the family to a lake and shows them their reflections. All the Martians are now humans.

As I wrote last month, there are no Martians, at least not intelligent ones, although the news released by NASA in early October that there is some form of flowing water on Mars increases the possibility that microbial life will ultimately be found. If there are to be intelligent Martians, they will have to be humans, and this is the point of director Ridley Scott's entertaining movie *The Martian*, starring Matt Damon as a stranded astronaut who survives against all odds. The film was based on Andy Weir's novel of the same name. The movie was shot in 3-D but we saw the perfectly enjoyable and impressive (and easier on your vestibular system) 2-D version.

The plot is a permutation of the "man alone" theme, most famously embodied in Daniel Defoe's 1719 novel *Robinson Crusoe* and more recently in the Robert Zemeckis movie *Cast Away*, starring Tom Hanks. Stories of men marooned out of reach of civilization and forced to fend for themselves create powerful reactions in the reader and engage natural human fears of loneliness and abandonment, as well as a question of character: "Will I be worthy to survive?" With only their intelligence and indomitable will to endure, these heroes fashion tools from materials at hand, weather all sorts of setbacks and solve basic problems that modern life has mooted, finally emerging triumphant

over nature to the shock of those who thought them lost.

One can trace this form of literature back to Homer's *Odyssey*. Odysseus (Ulysses), returning home with his companions from the Trojan War, completes his journey alone after his friends are picked off by various natural and supernatural phenomena: Scylla and Charybdis, the Cyclops, the Sirens, the nymph Calypso and Circe the Enchantress among them. His survival is not totally a matter of luck but reflects his personal ethos, to which we are introduced in the opening line of the epic. In the famous 1614 translation by George Chapman that so fascinated the poet John Keats 200 years later ([*On First Looking into Chapman's Homer*](#)) he is "the man...that many a way wound with his wisdom." In Samuel Butler's 1900 prose translation, he is the "ingenious hero." In 1919, A.T. Murray has him as "the man of many devices." Robert Fitzgerald's 1961 translation says he is a "man skilled in all ways of contending," while Richmond Lattimore's 1965 version calls him "the man of many ways" and Robert Eagles' beautiful 1996 translation describes him as "the man of twists and turns." Throughout the epic, Odysseus is clever, resourceful, willing to take a gamble and even, when it is called for, devious. And always determined to survive.



There are many true accounts of survival against all odds. *Robinson Crusoe* was apparently based (loosely) on the story of the Scottish sailor Alexander Selkirk, who was marooned on an island off Chile for 4 years until he was rescued in 1709. A somewhat more recent case is Antarctic explorer Douglas Mawson, a member of Ernest Shackleton's Nimrod expedition (1907-09). While Shackleton was trekking towards the as-yet undiscovered South Pole (he had to stop 97 miles short of his goal, later commenting "Better a

live donkey than a dead lion”), Mawson and colleagues were the first to climb 12,448-foot Mount Erebus and then trek to the South Magnetic Pole. In a later expedition in 1912, Mawson was exploring King George V Land some 500 miles away from his base when one of his two companions was lost in a crevasse with most of the group’s supplies. Mawson and Xavier Mertz trekked back towards their base in bitter, frigid weather, eating some of their dogs to survive. Mertz eventually died. Mawson made it back alone to the base only to find that the expedition’s ship had left just a few hours earlier. He overwintered in an ice cave, living off seal meat and cached supplies, until the ship returned the following spring.

Shackleton himself is the model for perseverance and creativity in the face of seemingly insurmountable odds. Although he was not alone, the circumstances favoring disaster over survival on his epic Imperial Trans-Antarctic Expedition (1914-1917) called for Crusoe-like tenacity and Odysseus-like ingenuity and leadership. Like the Greek hero, he had to be a leader of men, some of whom were near to defeat; unlike Odysseus he lost none of them. Sir Raymond Priestley, another member of Shackleton’s Nimrod expedition, wrote “For scientific leadership, give me Scott; for swift and efficient travel, Amundsen; but when you are in a hopeless situation, when there seems to be no way out, get on your knees and pray for Shackleton.” Everyone interested in exploration, whether earthly or cosmic, should be familiar with the Shackleton story, in his own words in *South* (1919), in Alfred Lansing’s exciting account of the expedition, *Endurance* (1959), or in Roland Huntford’s superb biography *Shackleton* (1986).



Mark Watney, Damon’s character, is just such a Shackleton-like individual: resolute, imaginative, inventive, tireless, and optimistic. He out-Macgyvers Macgyver in his ability to solve technical problems with materials at hand. He’s a botanist (I’m not sure why there’s a botanist on a Mars mission, as opposed

to a microbiologist or an ecologist, but there he is), but he’s also a chemist, an electrician, a mechanic, a plumber and a whiz with duct tape. The importance of duct tape to his survival can’t be overstated. Duct tape is like The Force in *Star Wars*: it’s dark on one side, light on the other side and it holds the universe together. Frankly, it’s hard for me to believe that there would have been enough duct tape (and clear plastic sheeting) brought along on a Mars mission to allow the stranded Watney to construct his life-saving environments, but the elements of this movie that strain credibility are pretty minor and serve the plot well (as compared to *Interstellar*, a movie that frequently bordered on silliness, or Brian de Palma’s dud *Mission to Mars*, a movie that is completely silly). If you recall the scene in *Apollo 13* where one of the mission staff says “We have to figure out how to connect *this* thing to *this* thing using *this* table full of parts or the astronauts will all die” then you have some idea of the source of tension of *The Martian*. *Interstellar* just threw out a bunch of arcane concepts that sounded scientific and profound. “[Dr. Brand’s] equation couldn’t reconcile relativity with quantum mechanics. You need more data. You need to see inside a black hole. And the laws of nature prohibit a naked singularity” intones none other than Matt Damon, playing a bad guy this time, at one point in *Interstellar*. I am sure that 99.99% of the people who see these movies don’t know about the fundamental conflict between quantum mechanics and general relativity, but everyone knows that feces make good fertilizer.



The plot is moved along by Watney’s frequent video diary entries, an excellent way to bring out his character and reveal his plans. He overcomes the major hurdles of his situation (food, oxygen, water, power and cabin heat for his surface rover and finally a way to communicate with Earth) using scientifically reasonable and understandable strategies. Having him find and re-energize the Sojourner rover from Mars Path-

finder was a nice touch. Sojourner conveniently never ventured more than 12 meters from the Pathfinder base station, making his find completely credible.



It was once said by Roald Amundsen, who beat Scott to the South Pole in 1912, that "Adventure is just bad planning." Indeed, the whole adventure in *The Martian* results from the crew's need to evacuate the surface during a wind storm so violent that it begins to tip over their rocket. Surely enough would have been known about Martian weather by the time the mission takes place (indeed, enough may be known already) to have straightforward design solutions that would have mitigated this risk. Does the return ship have to be tall and slender? How about 4 simple guy wires to lock it down? But more to the point, the wind on Mars isn't going to knock anything down. With a pressure of 0.006 atmospheres on the surface, effective wind force at any given velocity is more than an order of magnitude lower than it would be on Earth. The maximum wind speed recorded to date on Mars is only 67 miles per hour, so the wind pressure would be trivial and nothing would be knocked over. But then there'd be no adventure. In an interview in *Science* on September 25th, Jim Green, NASA's director of planetary science, who was an advisor on the film, acknowledges that the dust storm would have had insufficient violence to do any damage. Author Weir, in the same interview, notes that "I deliberately sacrificed reality for drama...In a man-versus-nature story, I decided I wanted nature to get the first punch in."



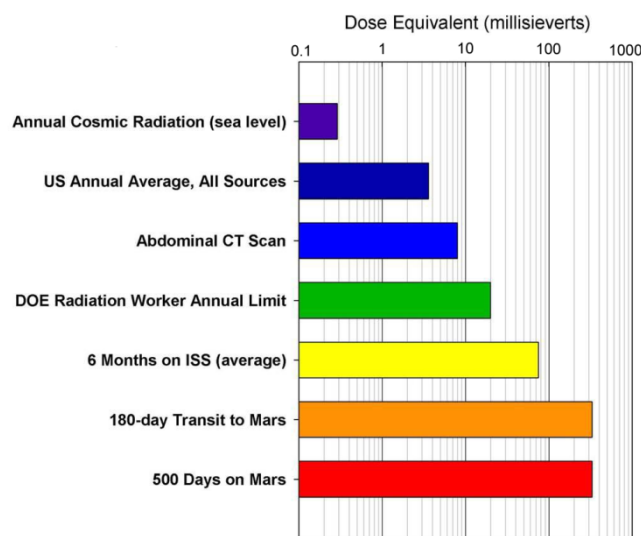
Even with these inconsistencies, the filmmakers tried hard to ensure that the scientific detail was as correct as it could be. Director Ridley Scott went to the Johnson Space Center to discuss many of the elements of a Mars mission with NASA staff, including studying plans for surface habitation technology. In the *Science* interview, Scott remarked that he asked Weir whether Whatney could be shown out on the surface in his EVA suit pouring liquid hydrazine from one container to another. Weir responded that because of Mars' low atmospheric pressure, the hydrazine would boil away, so the scene was never shot. Green also notes that the radioisotope power generator (RPG) that Whatney digs up to place in the cab of the surface rover, his solution for dealing with frigid night-time temperatures that can drop to minus 100° F., would have been too hot to handle. I also wondered what was powering the habitation unit if the RPG was off line.

An RPG is shielded and doesn't emit radiation. Environmental radiation is, however, a serious problem for Mars travelers. Weir admits that he "handwaved" around the radiation issues, assuming that "in the intervening time they'd invent some kind of material that takes care of it." In science fiction movies and on TV the danger of ambient radiation in space is generally dealt with by simply ignoring it, unless it needs to move the plot along, in which case we get verteron particles or Berthold rays (two of the many deadly emanations of *Star Trek*). Everybody walking around in suits of lead armor to block more prosaic X-rays and charged particles just doesn't cut it. Who would want to see *Seven of Nine* dressed like that?



The radiation dose in interplanetary space is substantial. It comes mainly from three sources: trapped radiation in the Earth's Van Allen Belts, galactic cosmic ray (GCR) background radiation and Solar Proton Events (SPEs) due to solar flares and coronal mass ejections (CMEs). A large flux of charged particles can damage electronic equipment. For humans the problem is not only the particles, but also ionizing X-rays and gamma rays that accompany their production and movement through space. An [in-depth analysis](#) of

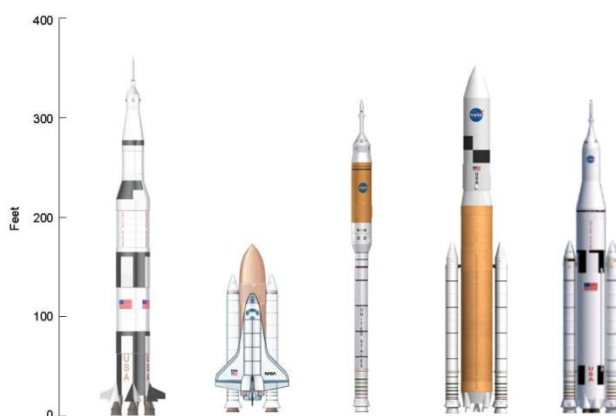
radiation sources and possible mechanisms of mitigation was released in 2004 by the European Space Agency. It's a formidable 194-page document, reflecting the detail necessary to understand space radiation physics and plan for palliative technology. Solar activity is now trackable from satellites and Earth stations. You can even sign up for personal space weather emails from the [Space Weather Prediction Center](#), a branch of the National Oceanic and Atmospheric Administration. When a solar event occurs, astronauts in the International Space Station are ordered to take refuge in a shielded chamber on board before the particles hit. A safe area might be constructed aboard a large interplanetary space ship, such as the film's *Hermes* mother ship, but it's not feasible to have such a compartment in the smaller spacecraft that will be deployed in early Mars missions. That such flares can be of immediate risk to space missions is evidenced by the fact that at least 12 Earth-orbiting satellites have been destroyed by radiation bursts originating in the Sun. Radiation exposure will need to be solved for a Mars trip in a way that doesn't compromise other elements of the mission, mainly burdening the boosters with too much weight.



The Sun is entering a long-term quiet phase, lasting several, or even many, 11-year solar cycles (another prolonged "Maunder minimum" has been suggested by solar scientists). This may reduce the risk somewhat. However, total solar radiation doses differ between solar minima and maxima only by a factor of 3 (Badhwar *et al.*, An analysis of interplanetary space radiation exposure for various solar cycles, *Radiation Research* 1994:138:201-208). In addition to the constant level of solar emission, a "quiet" sun can still experience sudden radiation-inducing events.

The absence of a magnetic field on Mars means that solar particles will rain down over the planet's entire surface, rather than being confined to the poles as on Earth. The thin Martian atmosphere won't intercept the particles to any meaningful degree. There are auroras on Mars but they are associated with local crustal magnetism rather than a global magnetic field. Martian auroras radiate in the ultraviolet, the photons arising from charged particle interactions with carbon dioxide rather than molecular oxygen and nitrogen as on Earth. Since astronauts will be exposed to higher levels of radiation throughout the journey to and from Mars and during their stay on the surface, their long-term risk of cancer will rise significantly. The risk would be higher if there are many solar flares during the expedition.

There have been dozens of proposals for missions to Mars dating back to an original scheme by none other than Wernher von Braun. In 1948, von Braun wrote *Das Marsprojekt* (published in English in 1953). It envisioned a mission to the red planet in 1965 using a fleet of 10 spacecraft assembled in Earth orbit from parts brought by hundreds of reusable space shuttles. Seventy crew members would spend 443 days on the surface. Some of the technological solutions for the landing were based on erroneous assumptions about the density of the Martian atmosphere. In addition, the serious problem of high radiation levels in space was then completely unknown and therefore couldn't be taken into account when proposing spacecraft design. Considering that no rocket had yet achieved Earth orbit, von Braun's scheme can only be considered impracticably imaginative, but it demonstrated an understanding of just how much effort and resources would be required to get to Mars and back.



From left to right: Saturn V, Space Shuttle, Ares I, Ares V, Space Launch System (NASA)

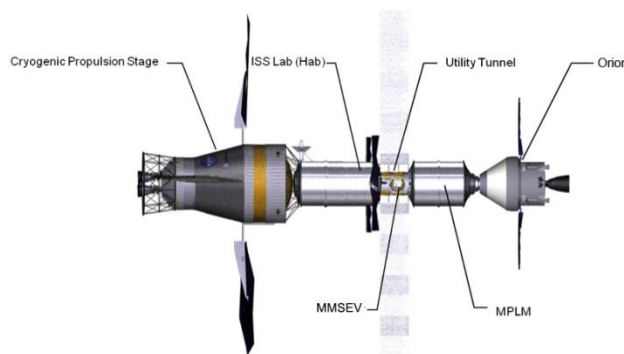
In *The Martian*, the mission is named “Ares III.” Ares was component of NASA’s Constellation program, first proposed in 2005. The goals of Constellation were to complete the ISS and then return to the moon by 2020 using the next generation of manned space rockets that would ultimately be capable of reaching Mars. The flight plan differed from Apollo in that the crew and the necessary supplies would be launched by different vehicles, Ares I for the crew and Ares V for the supplies. The latter would have been the most powerful rocket ever built, with the ability to carry twice the payload of Saturn V. The crew would ride on Ares I in the Orion Crew Exploration Vehicle, similar to the Apollo command module and service module scheme, with an additional Launch Abort System component. The Constellation program was canceled in 2010 for budgetary reasons. NASA still has a long-term plan for space exploration that includes Mars. The Ares boosters were replaced by a more modest program of rocket development based on the Space Launch System (SPS), a smaller booster, and the Orion concept was also modified, migrating to the Orion Multi-Purpose Crew Vehicle, which successfully underwent its first unmanned orbital test on December 5, 2014. Orion has only 79 cubic feet of living space for each of its 4 astronauts so an additional component, the Deep Space Habitat, will be required. This has been proposed but not yet built.



Undoubtedly banking on public interest created by *The Martian*, on October 8, 2015 NASA released a summary of its plans for manned missions to the red planet. Entitled [Journey to Mars](#), it recapitulates the use of the SPS and Orion in a step-wise program starting with lunar missions, then an “asteroid redirect” mission and finally a Mars mission. One new technology that will be used is solar electric propulsion, using solar energy to accelerate xenon ions to create the thrust necessary for interplanetary travel. The remarkably successful Dawn mission to Vesta and Ceres was the first use of this technology.

What’s not in the report is the daunting problem of financing future manned space exploration. Getting

enough money out of Congress for space research is hard enough for ground-based observatories and relatively inexpensive (compared to manned space travel) robotic space missions. The case can be made that robotic probes are just as productive as and far more cost effective than manned missions. What’s missing, of course, is romance, the possibility of adventure, and perhaps the claim of conquest.



The proposed Deep Space Habitat and Orion (NASA)

The Ares III mission in *The Martian* is advanced beyond any current NASA planning. The mother ship *Hermes* is huge, with a rotating segment that allows the astronauts to experience Earth-like G-force, as on the Jupiter-bound *Discovery* in Stanley Kubrick’s *2001: A Space Odyssey*. It seems doubtful that this level of spacefaring technology is achievable in 20 years. The first mission to Mars would be a completely weightless round trip, except for a spell of 0.38 Earth gravity while on the Martian surface. On a space mission there are all sorts of human problems to solve. Many of these are currently being researched aboard the International Space Station. The mundane concerns of daily life that must be dealt with during the voyage are discussed in a wonderful book, *Packing for Mars* by Mary Roach, published in 2010. If you’re a supporter of manned exploration of Mars (one WAA member has the license plate MARS2033) you’ll want to read this thoroughly researched, comprehensive and often humorous book. There’s a good bit of real life that needs to be lived on the way to Mars, not the least of which is how to defecate when weightless. That’s a subject generally avoided in NASA press releases, but Roach makes sure that you understand just how complicated and nasty this necessary process will be.

Politics enters into the film not in the guise of a budgetary battle over mission financing, but in managing the discovery that Whatney is still alive. The initial inclination of the very serious and perplexed NASA administrator, played by Jeff Daniels, is to leave Whatney for dead, but he knows that the knowledge

of his survival could never be suppressed and that popular sentiment would call for his rescue, even though that seems physically impossible. Up to now, space catastrophes have been sudden and irretrievable. The Columbia and Challenger disasters were instantaneous failures. The Apollo 13 crew was rescued, and had they not been it would not have been for lack of trying. I am sure that a high-level discussion was held before the Apollo missions about what to say if the rockets on the LEM failed to ignite, stranding the astronauts on the lunar surface with no possibility of retrieval. Leaving a marooned astronaut to die is something for which NASA and its astronauts have to be prepared. The night before the Normandy invasion on June 6, 1944, commanding General Dwight D. Eisenhower wrote two messages, one touting its success and the other apologizing for its failure. I am sure NASA has prepared comments for any eventuality.



The elements of the plot that come together to make Whatney's retrieval possible (a smart orbital dynamist's calculations, a secret Chinese rocket booster and the willingness of the Chinese to offer it, the presence of a return rocket on Mars already placed there for a future mission and the friendly mutiny of the crew of the Hermes) are serendipitous in the extreme. Suffice it to report that, after the movie, Elyse said to me "The only part of this movie that was science fiction was that the Chinese government was cooperative." Maybe at the time the action in the movie takes place our governments are more collaborative, but it's a bit hard to imagine given current difficult relations that any secrets or precious, expensive technology would be shared. Maybe we're being too cynical. U.S.-Russian space cooperation began before the fall of the Soviet Union and continues today even in the face of a Russian government looking to oppose the U.S. in many international areas.

The believable locations for the surface of Mars were shot in Wadi Rum in Jordan, which has served as the locale for a number of other recent Mars movies. The rest of the movie was shot in Budapest.

Director Ridley Scott has made a few science fiction movies, beginning with *Alien* in 1979. One should also count as SF his famous 1984 Apple Macintosh Super Bowl commercial, set at is it in an Orwellian future. He's had a few clinkers, notably *Prometheus*, which I found to be very tedious, but to me his greatest achievement, sci-fi or otherwise, is *Blade Runner* (1983), a film that asks the most fundamental question in art: What does it mean to be a human being? *The Martian* doesn't delve quite as profoundly into the human condition, but like *Blade Runner* the characters are motivated implacably by their will to survive.



Top: Wadi Rum. Bottom: Burns Cliff (Mars Spirit Rover)

By the time you read this, *The Martian* will probably be gone from the theaters. *Sic transit gloria mundi*, as the saying goes. If you missed it, you'll have to experience it on a home screen. It was said of the partnership of Fred Astaire and Ginger Rogers that "He gave her class, she gave him sex appeal." That may also be said of the relationship between *The Martian* and NASA. Revived public interest in manned space flight and Martian exploration is clearly one possible consequence, but hopefully not at the expense of NASA's incredibly productive robotic missions and space observatories that have provided so much new knowledge. ■

Outreach at Somers Library, October 19th

At the invitation of Betsy Bishop of the Somers Library, WAA held an outreach program at Reis Park on Route 139 in Somers. At least 75 enthusiastic students and their parents attended under a lovely sky with a 6-day moon. The outreach program coincided with a display of WAA member Scott Namacher's astrophotography at the library.

We were forwarded this article by one of the young attendees published the Somers Intermediate School newspaper.

Space Gazing

By: Jay Wilkinson

Time for space gazing! The Somers Library sponsored a space gazing event so that we can see the stars for free! They also tell some really cool facts. I, **myself** learned some really cool facts! For example do you know how a star dies?

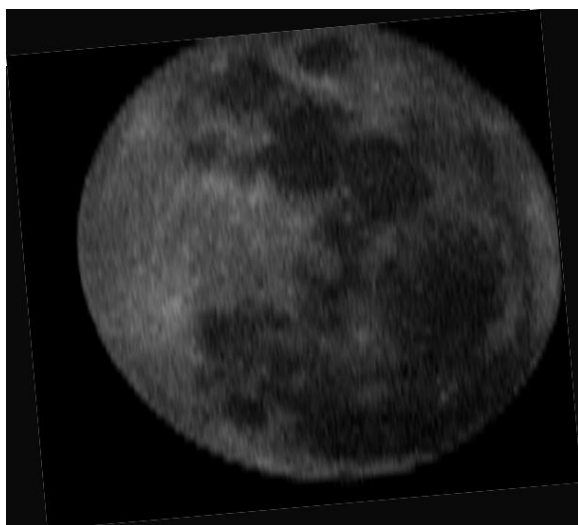
Different stars, depending on their sizes die in different ways. A star about the size of our sun usually dies when it burns all its hydrogen and fuel. Then the outer rim will expand and then it will collapse. That's how, (sadly) a star about the size of our sun will die.

Now, back to the star gazing event at Upper Reis Park last Monday night at about 7:30 pm. When I got there, I saw about 6 telescopes pointing at different places in space. I looked at many things but I'm only going to name a few. I looked at the planet Neptune. Also, I saw 2 stars close together (when you see it from far it looks like 1 star). I also was able to see the Moon, and also 2 white dwarfs (that is what a smaller star becomes when it runs out of fuel).

The Moon has lots of craters. Craters are large holes on the surface of the moon. The telescopes are so powerful they can see about 2,500 times from what we can see with our eyes!

I didn't think it would be fun, but boy was I **WRONG**! I'd like to thank the Somers Library for convincing Westchester Astronomy Club to come all the way to Upper Reis Park in the cold, cold night and setup their big telescopes. Then they helped us kids find all kinds of cool things in space so that we can see all these things in space!

Astrophotos



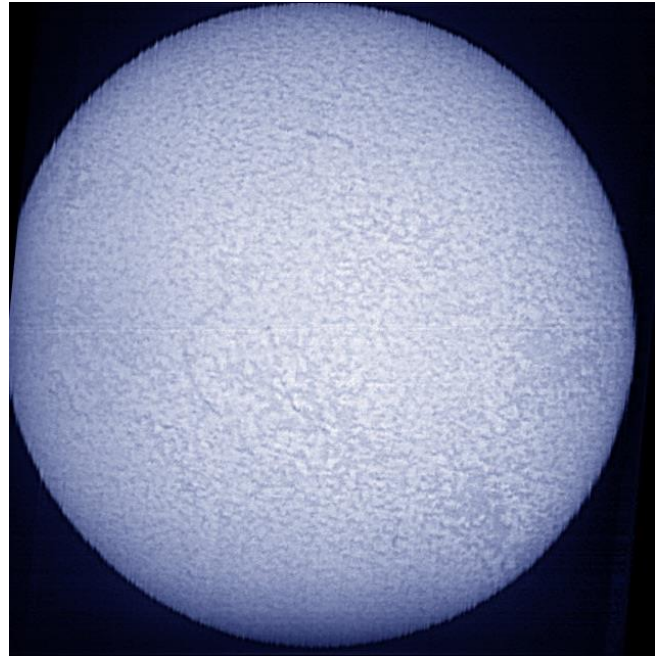
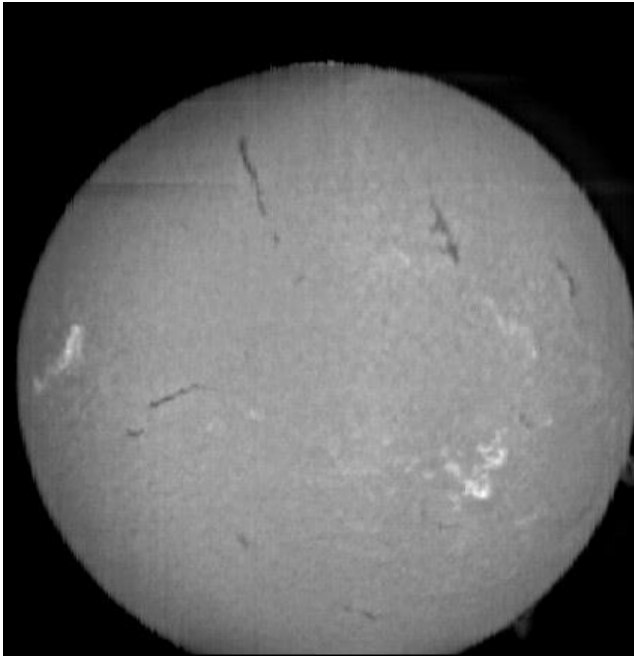
← The Moon Through SHG

John Paladini took this image of the Moon through his spectroheliograph (SHG) using the sodium wavelength. Ken M. Harrison, author of *Astronomical Spectroscopy for Amateurs*, initially thought John might have been the first to image the Moon through a SHG although further research suggested a South American astronomer had done so a few years ago.

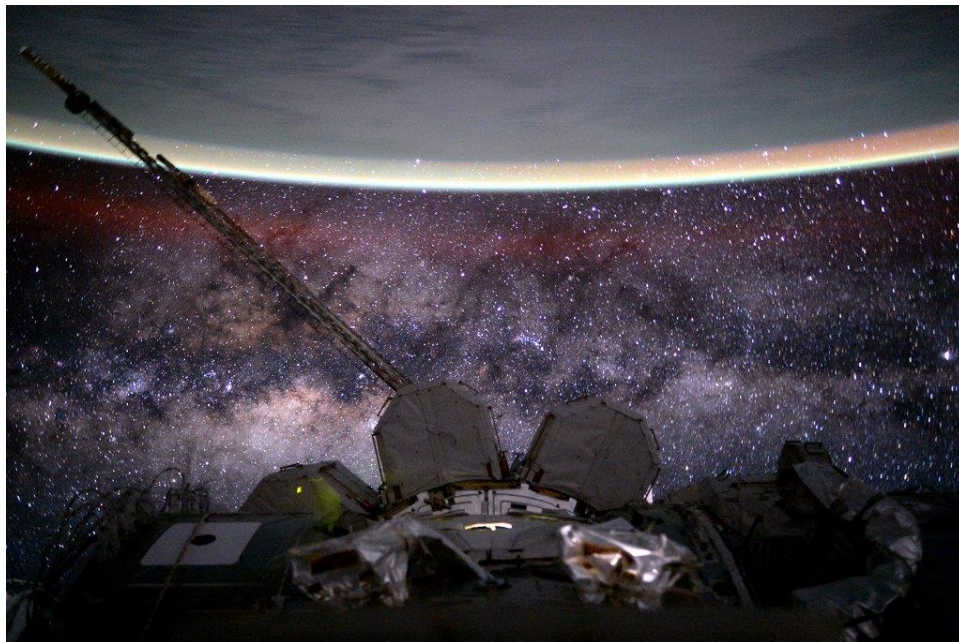


Cliff faces on the western edge of the Mare Humorum see dawn as they emerge from the terminator when the moon is about 10.5 days old. They run from the 100 km wide crater Gassendi, running southwest and then south to the 64 km crater Doppelmayer. On the southeastern edge of the Mare Humorum are the concentric Rima Hippalus, a system of wide rilles. Stellarvue SVR-105 triplet refractor, 2x Barlow giving 1470 mm focal length, QHY-5L-II monochrome camera, best 300 of 3000 frames. Seeing 4/10. October 23, 2015, Larchmont, NY.

--Larry Faltz



John Paladini took these two photos of the Sun with his spectroheliograph. On the left, the image is at the h-alpha wavelength while the image at the right is H-beta.



Since November 2000, people have been living continuously on the International Space Station. To celebrate humanity's 15th anniversary off planet Earth, consider this snapshot from space of our galaxy and our home world posing together beyond the orbital outpost.

Credit: [APOD](#). Image Credit: [NASA](#), [Scott Kelly](#)

Our Solar System Is *Almost* Normal, But Not Quite

Ethan Siegel

It was just over 20 years ago that the very first exoplanet was found and confirmed to be orbiting a star not so different from our own sun. Fast forward to the present day, and the stellar wobble method, wherein the gravitational tug of a planet perturbs a star's motion, has been surpassed in success by the transit method, wherein a planet transits across the disk of its parent star, blocking a portion of its light in a periodic fashion. Thanks to these methods and NASA's Kepler spacecraft, we've identified many thousands of candidate planets, with nearly 2,000 of them having been confirmed, and their masses and densities measured.

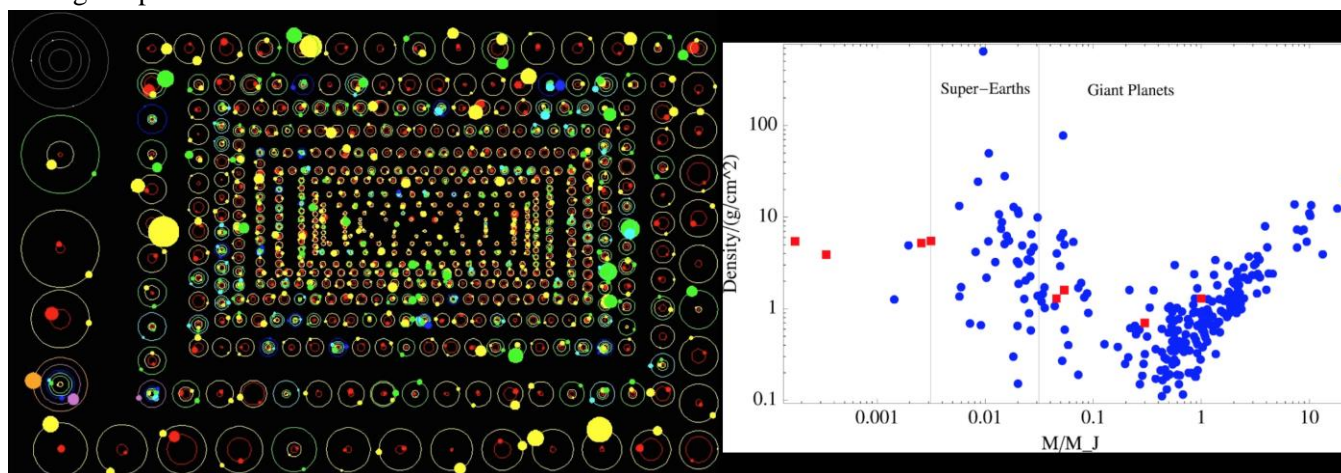
The gas giants found in our solar system actually turn out to be remarkably typical: Jupiter-mass planets are very common, with less-massive and more-massive giants both extremely common. Saturn—the least dense world in our solar system—is actually of a fairly typical density for a gas giant world. It turns out that there are many planets out there with Saturn's density or less. The rocky worlds are a little harder to quantify, because our methods and missions are much better at finding higher-mass planets than low-mass ones. Nevertheless, the lowest mass planets found are comparable to Earth and Venus, and range from just as dense to slightly less dense. We also find that we fall right into the middle of the "bell curve" for how old planetary systems are: we're definitely typical in that regard.

But there are a few big surprises, which is to say there are three major ways our solar system is an outlier among the planets we've observed:

- All our solar system's planets are significantly farther out than the average distance for exoplanets around their stars. More than half of the planets we've discovered are closer to their star than Mercury is to ours, which might be a selection effect (closer planets are easier to find), but it might indicate a way our star is unusual: being devoid of very close-in planets.
- All eight of our solar system's planets' orbits are highly circular, with even the eccentric Mars and Mercury only having a few percent deviation from a perfect circle. But most exoplanets have significant eccentricities, which could indicate something unusual about us.
- And finally, one of the most common classes of exoplanet—a super-Earth or mini-Neptune, with 1.5-to-10 times the mass of Earth—is completely missing from our solar system.

Until we develop the technology to probe for lower-mass planets at even greater distances around other star systems, we won't truly know for certain how unusual we really are!

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Images credit: NASA / Kepler Dan Fabricky (L), of a selection of the known Kepler exoplanets; Rebecca G. Martin and Mario Livio (2015) *ApJ* 810, 105 (R), of 287 confirmed exoplanets relative to our eight solar system planets.