SkyWAAtch

Galactic Neighbor

Scott Nammacher used the used iTelescope in New Mexico (T-14) to take the subs for this image of the Andromeda galaxy (M31). The images were taken November 26/27th through a Takahashi 106mm telescope with an SBIG STL 1100 camera. Scott processed the image in MaximDL, then Registar and finished in Photoshop.

Thought to contain a trillion stars, M31 is the most massive member of the Local Group of galaxies. Two satellite elliptical galaxies M32 (9 o'clock from M31's core) and the larger M110 (4 o'clock) are clearly visible in this photo.

In This Issue . . .

Events for January 2015

WAA January Lecture

"The Sun as a Star: Stanford's Wilcox Solar Observatory"
Friday January 9th, 7:30pm
Lienhard Lecture Hall, Pace University Pleasantville, NY

For almost 40 years Stanford's Wilcox Solar observatory has produced solar mean magnetic field measurements and large scale photospheric magnetographs. These observations complement high-resolution observations from terrestrial observatories and data from satellites to provide input to models of the interplanetary medium and geomagnetosphere for "space weather predictions." Dr. Josh Knight will review terrestrial solar observing techniques, the physics of spectroscopic magnetic field measurements and the physics of the solar wind and interplanetary magnetic field, followed by a discussion of the specifics of the construction and operation of the Wilcox Solar Observatory. As in all scientific projects, issues arose in the operation of the Wilcox Solar Observatory that were not envisioned before the construction was completed.

Josh Knight received a BS in Engineering Physics from Cornell University in 1968, a MS in Applied Physics from Stanford University in 1974 and a PhD in Applied Physics from Stanford in 1978. His thesis was titled Reverse Currents in Solar Flares. He was a Research Associate and Adjunct Professor at Stanford from 1978 to 1981 pursuing research in solar physics and providing instruction in undergraduate observational astronomy. Both as a graduate student and as a Research Associate, Josh was part of the Wilcox Solar Observatory team. Josh joined IBM in 1981 and has since done research and development in computer hardware and software while maintaining a strong interest in astronomy. Free and open to the public. Directions and Map.

Upcoming Lectures

Lienhard Lecture Hall,
Pace University Pleasantville, NY

On February 6th, our lecturer will be Brother Robert Novak, Professor of Physics at Iona College, who will speak on the James Webb Space Telescope. Free and open to the public.

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

Starway to Heaven

Ward Pound Ridge Reservation,
Cross River, NY

There will be no Starway to Heaven observing dates for January or February. Our next Starway to Heaven is scheduled for March 14th.

New Members. . .

John Tanzillo - Buchanan
Edward John Monk - Hawthorne

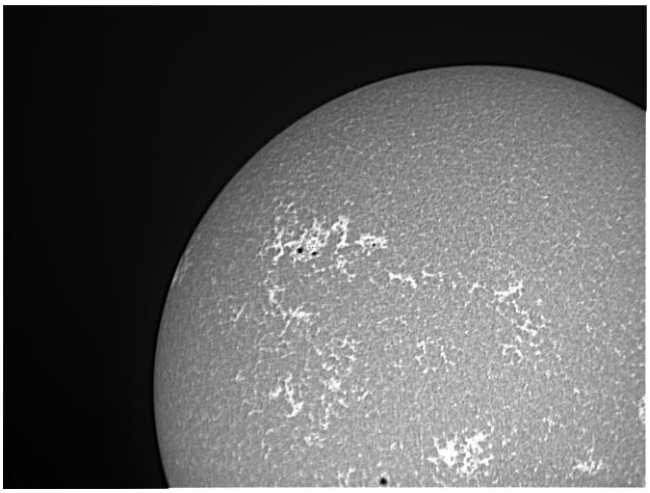
Renewing Members. . .

Cliff Wattley - Ridgefield
Warren Lindholm - Cortlandt Manor
Daniel R. Poccia - Cortlandt Manor
Kevin Doherty - White Plains
Harry S. Butcher, Jr. - Mahopac

WAA Apparel

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

- Caps and Tee Shirts ($10)
- Short Sleeve Polos ($12)
- Hoodies ($20)
- Outerwear ($30)



Courtesy of John Paladini is this solar image. Notes John: Here is my first caK double stack that is using 2 filters to make more image contrast --1.6A lunt caK + omega 2A filter.

Almanac
For January 2015 by Bob Kelly


Jan 4 Jan 13 Jan 20 Jan 26

In 2015, we'll get to know Pluto a lot better as New Horizons probe encounter starts now with good photos by late Spring and the flyby occurring in July.

Mars sets at 8pm all month, you can set your watch by it, but it's very small, even in a telescope. Venus is bright, but tiny and low in the west, but when you find it, Venus will point you toward a good apparition of Mercury below Venus for the first half of the month. Mercury makes a pass at Venus, but falls short by less than one degree on the 10th. Neptune is within a degree of Mars around the 19th, and similarly close to Venus at the end of the month.

Jupiter is up by 8pm now and it'll be higher in the sky at that time by the end of the month. It's coming up on its largest size for the year, which occurs in February. So it's a great time for views cloud belts, moons and more even in small telescopes if the atmosphere isn't too turbulent. Look for days when our planet's jet stream isn't overhead for the best views.

Satellite shadows play on Jupiter's face, with three at once late on the 24th. Jupiter is small in the sky compared to our Moon, but it's has more sunlit area from our point of view than all the other planets put together.

Uranus is well placed in post-twilight prime time if you can tear yourself away from the winter constellations. Orion levitates skyward like a magician's trick right after sunset. Spend some time lost in the Orion Nebula at high power if the night air is steady, then zoom out and look at the glows and darks of the nebulae around the sword and belt of Orion.

Comet Lovejoy, designated C/2014 Q2, streaks northward into our skies early this month… but will it be bright enough for even the most casual observer or will we be looking at wonderful long-exposure photos that make it look like it's jumping out of the sky while we scan the skies with binoculars for a faint fuzzy? Recent observations estimate its brightness at magnitude +5, so it's worth getting a chart with its position to help us find it as it passes to the lower right of Orion. It's 44 million miles from us at its closest and at its brightest from now into mid-January.

Saturn starts the year beautifully in the morning sky. You'll need that new telescope to see its rings, but it's worth the effort, especially now that it stays dark so late in the morning. Saturn looks like a chip off the Moon on the morning of the 16th.

The Sun is coming off its peak sunspot numbers, after a weak solar maximum, but there are still some nice sunspot groups from time to time – so keep on the lookout (with a properly filtered telescope). Solar outbursts are creating some beautiful auroras, mostly visible well to our north.

Sunrise lines up with the NYC street grid around the 5th, which is also the date of the latest sunrise. Sunset has already moved ahead by more than five minutes since earliest sunset on December 8th.

Earth is closest to the Sun for the year on January 4th. We are at 1½ million miles closer to the Sun than its average distance. So why don't we call it the 'Supersun'? The earth's orbit around the sun doesn't have the wide ranges of the Moon's orbit around the Earth, so we only get a 4 percent change in the apparent size of the Sun, compared to almost 13 percent for our Moon from an extreme perigee to apogee (see September's perigee full Moon, this year during a lunar eclipse).

The Moon tips more than in previous months, giving us a sideways peek at the ridges and dark lava pools of Mare Orientale around the 15th, just after last quarter Moon in the morning sky.

The International Space Station makes it's appearances in the morning sky from the 5th through the 29th.

Westchester
Amateur Astronomers

Annual Meeting, December 5th

The official annual meeting of Westchester Amateur Astronomers, Inc. took place on December 5th just prior to a wonderful lecture by Michael Tuts, Chairman of the Department of Physics at Columbia, on how the ATLAS detector at the Large Hadron Collider is probing gravity and looking for microscopic black holes.

The annual election of officers was held and the current officers were re-elected for 2015. The officers are Larry Faltz, President; Charlie Gibson, Senior Vice President; Douglas Baum, Treasurer; Paul Alimena, Vice President for Membership; Pat Mahon, Vice President for Programs & Speaker Coordinator; Bob Kelly, Vice President for Field Events. The other club leaders are David Parmet, Webmaster & Public Relations Chair; Tom Boustead, Editor, SkyWAAtch Newsletter; Claudia Parrington, Assistant Vice President for Liaison.

Larry reported on the club's activities and finances in 2014 and plans for 2015. Membership has grown over the past two years and as a result the club has sufficient financial reserves to support its operations. We will continue to keep dues at a nominal $25. Many new and renewing members are taking advantage of the ease of PayPal on our web site to remit their dues.

Our well-attended lecture series featured a wide variety of speakers and topics, helped no doubt by the excellent facilities at Pace University. We held 8 star parties during the year; only one month's pair of star parties was a complete weather washout. An extra event on the Sunday of Memorial Day weekend, announced only 24 hours in advance, was also very successful. WAA was asked to do a number of outreach programs in 2014, including two lectures at the Greenburgh Library, a talk and star party at Wainwright House in Rye, observing at the Quaker Ridge School, a talk at the Horseshoe Harbor Yacht Club in Larchmont and a remarkably well-attended sidewalk astronomy event in Mamaroneck in June. Eighteen club members took shifts at our NEAF booth in April and it was a major source of connection for members who might encounter each other primarily in the dark at the star parties!

We continue to take advantage of the ease and speed of communicating via email to distribute club information and monthly newsletters. Postings on Facebook seemed to be a major way of reaching non-club members interested in coming to the viewing events.

For 2015, we will continue all of our activities, with lectures, star parties, outreach events and a NEAF booth again this year. NEAF takes place on Saturday April 18 and Sunday April 19, so mark your calendar. We will send out requests for participation in late January. We continue to receive requests for outreach programs and talks, and we would like more members to be involved with these programs. In addition, we have formed a relationship with Byram Hills High School in Armonk to upgrade their planetarium, which currently houses a 14" Celestron SCT on a non-goto mount. A committee of club gear-heads and astrophotographers will be formed to assist the faculty in this project.

Larry announced his intention to form an Advisory Board to assist the officers in governing the club and to serve as a platform for development of new leadership. Broadening the base of involved members is an important goal in a volunteer organization. The club's Bylaws are unique in that the elected officers form the Board of Directors, opposite from what happens in most not-for-profit organizations. We need a larger base of members to participate in governance activities and some of the maintenance functions of the club. We would like 5-7 club members to volunteer for the Advisory Board to meet with the officers and grow into the leadership positions.

Important 2015 Dates

Star Parties (Saturday)	
Primary Date	Rain/Cloud Date
March 14	March 21
April 11	April 18
May 9	May 16
June 13	June 20
July 11	July 18
August 8	August 15
September 12	September 19
October 10	October 17
November 07	November 14

Lecture Dates (Friday)	
January 9	June 5
February 6	September 11
March 6	October 2
April 10	November 2
May 1	December 4

NEAF: April 18-19 (Rockland Community College)
Club picnic: Saturday, June 6th (Ward Pound)

The Astronomer at the Movies: *Interstellar*

Larry Faltz

Spoiler alert! By the time this is published, I suspect that everyone who wants to see *Interstellar* has seen it, but if you haven't and you still feel like giving it a try, stop reading now and come back after you've taken in the movie, since I'm going to discuss some of its important plot elements. I don't want my opinion of the movie to taint your objectivity or potential enjoyment. It's possible, in fact likely, that we will disagree. The most important thing about experiencing art of any form, even the relatively prosaic, is that you form your own opinion. A proper critic shouldn't merely tell you what he thought of the work, he explores what it made him think about.

It's sometime in the near future. The Earth is dying. Crops are failing, dust is everywhere, and mankind has turned inward into some form of suicidal helplessness. The idea that technology can solve problems is rejected; popular culture, as seen in the grade-school curriculum, holds that the Apollo moon landings were faked for political purposes, to force the Soviets into a space race that will bankrupt them. Science in general is demeaned. It's a streak that's just under the surface in the America of today, so who's to say that it wouldn't be in the ascendancy in a future time of existential crisis?

Within this setup, *Interstellar* explores the relationship of Cooper (Matthew McConaughey), a former NASA astronaut turned farmer, society's highest calling in a starving world, and his bright and seemingly independent daughter Murphy, who's named after Murphy's Law ("anything that can go wrong, will"). Murphy has sensed odd phenomena in her bedroom, which she initially ascribes to a poltergeist who is trying to communicate with her, much to Cooper's amusement. He discovers the phenomena actually exist and seem to be messages encoded in gravitational waves. He deciphers them with Murphy's help and is led to the hidden remnants of NASA, who just happen to have constructed spacecraft that were sent to explore a galaxy on the other side of a wormhole that appeared near Saturn 50 years before. Rather mysteriously this occurrence seemed to have no impact on the science deniers, yet I think if a wormhole appeared today, even creationists would take notice! A dozen solo explorers were sent through the wormhole to search for planets on which the human race can resettle, thus avoiding extinction, and 3 signals have come back. Cooper volunteers to command a mission to find these signals and determine if they were sent from planets feasible for resettling the human race. In doing so, he must leave his daughter back on Earth. She reacts badly to his decision.

The relationship between father and daughter is a subject as old as literature. A Greek legend tells how the goddess Artemis demanded that Agamemnon sacrifice his favorite daughter Iphigenia in order to be allowed to sail for Troy. Shakespeare's plays include many important father-daughter relationships, foremost among them Lear and his daughters Goneril, Regan and Cordelia in *King Lear* and Prospero and Miranda in *The Tempest*. Many of the operas of Giuseppe Verdi are about the relationship between fathers and daughters, a subject that haunted Verdi after the death of his 17-month old daughter Virginia (followed within a few months by his son and wife). *Rigoletto*, *La Traviata*, *Aida*, *Nabucco* and *Simon Boccanegra* are particularly driven by stresses in the father-daughter bond. Verdi even wanted to write an opera based on *King Lear*, but he never did it, to our eternal cultural loss. Many novels have strong father-daughter relationships: Harper Lee's *To Kill a Mockingbird* immediately comes to mind.

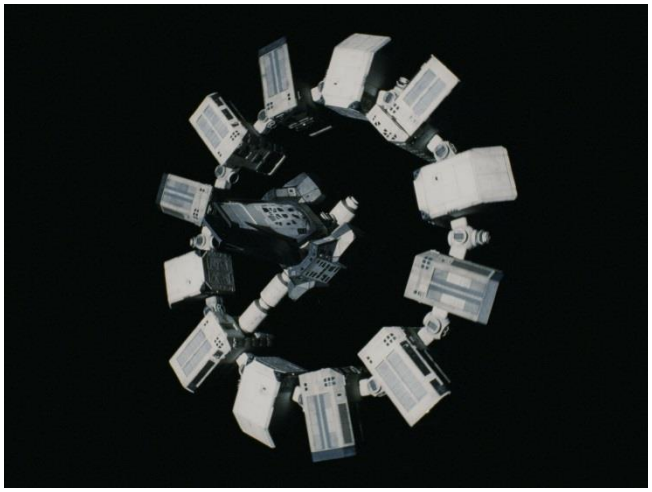
Some science fiction movies have utilized father-daughter plot devices. The breakdown of the relationship between Dr. Morbius and his daughter Altaira energizes much of the plot in one of the greatest sci-fi movies, *Forbidden Planet*, which is to some extent a retelling of *The Tempest*. Josie Foster, in *Contact*, is propelled into SETI research partly in response to the sudden death of her astronomy-loving father, and then is reunited with his alien avatar in the rather silly conclusion to an otherwise interesting movie. The relationship between Cooper and his daughter (played as a 10-year old by Mackenzie Foy and as an adult by Jes-

sica Chastain), particularly her reaction to his decision to embark on the journey, is the central element of the drama. It's actually much more important than the aspect of the plot that is most touted in the movie's publicity: the search for a new home for humanity.

You think this is going to be a space movie, and a lot of it takes place in outer space, but frankly, it's not. Yes, there are black holes and wormholes, and take-offs and landings and lots of talk about relativity and quantum mechanics and time dilation, but the fact is that the physics is manipulated, distorted and sometimes ignored simply to heighten the drama surrounding the father-daughter relationship.

But Interstellar is touted as a space movie and so we amateur astronomers need to consider its scientific *bona fides*. How much disbelief do we have to suspend? The right amount or too much?

I have to admit I have a tough time when liberties are taken with science unless the setting is far enough in the future that the impossible can simply presumed to have been conquered by inevitable advances in theory and technology. As Arthur C. Clarke so famously wrote, "Any sufficiently advanced technology is indistinguishable from magic." Magic can be fun and that's how we can enjoy movies with faster-than-light drive, quantum teleportation and an infinite diversity of humanoid bipedal aliens that just happen to be between 5 and 6½ feet tall and weigh between 120 and 250 pounds. You've got to package all of this magic and fantasy together to pull it off. By ignoring important details of reality and logic while still trying to come across as scientifically accurate (gravity expert Kip Thorne is one of the executive producers) in a future not very far away, *Interstellar* gets it wrong enough to bother physics curmudgeons like me.



Cooper gets into outer space by renewing his relationship with NASA chief Dr. Brand (Michael Caine) after he stumbles upon the hidden NASA site. The idea that NASA could build, fuel and launch advanced spaceships on a shoestring budget from a secret location in a world in which technology is disdained is simply ludicrous. The space complex appears to be hidden in the middle of nowhere. We see a few dozen busy workers scurrying to get things done. Where do they live? How do they get to work? Where do they go shopping? How can they keep all that secret? And everyone is wearing ties and jackets: who are they trying to impress? To understand what we're expected to believe and what the stripped-down, secret NASA of *Interstellar* has pulled off; recall that the much simpler Apollo project employed 400,000 people over the course of its planning, construction and operations. My wife Elyse pointed out that this notion of a hidden-in-plain-sight mega-technology complex has parallels in those James Bond movies whose villains construct gigantic facilities, hollowing out mountains if necessary, and employ legions of mercenaries while nobody in the outside world seems to take any notice (think of the subterranean missile facility in Japan in *You Only Live Twice*, for example). There's a wonderful parallel in the story of Aladdin in *The Thousand and One Nights*. Aladdin, living in poverty, wants to impress the Caliph so he can marry his beautiful daughter. He rubs the lamp to summon the genie and instructs him to build a magnificent palace right next door to the Caliph's, twice as large and far more resplendent, and do it that night while everyone is sleeping. Sure enough, in the morning everyone wakes up and there's Aladdin's palace. Do they say "Holey moley! That's not right. Where did THAT come from?" No! Instead, they say "Wow, that Aladdin is sure a great guy. He should definitely marry Fatima."

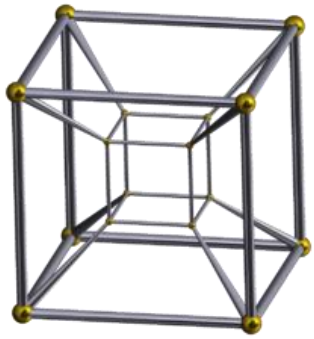
It works charmingly in the *Nights*, but not in anything claiming a connection to reality.

Cooper's spaceship is launched from within the NASA building. Millions of pounds of thrust create a rather substantial amount of flame and exhaust. It's not smart to do that indoors. In the 7th grade, I made a tiny solid fuel rocket out of a pinch, maybe half a gram, of powdered magnesium and some potassium nitrate from my Gilbert chemistry set and packaged it in a two inch long aluminum foil tube. My friend Zvi and I set it off in his bedroom. It made a big flash and zipped across the room in a second, but every surface, including us, was covered with fine magnesium oxide dust, to our vast amusement but not his mother's. Imagine if I had used a hundred tons of the stuff.

Travel through a wormhole into another galaxy and an encounter with a black hole are critical to the plot. The wormhole and black hole are depicted accurately according to current theories, at least from a distance. In particular, the black hole has an accretion disk orbiting its event horizon and light from objects behind it is bent around its circumference. The tidal effects of highly curved space (meaning very intense gravity) are ignored except for time dilation. They have to be, of course, otherwise it would be a pretty short and pointless movie (shall we joke and say it would have a "thin" plot?). The requisite *2001*-style effects accompany the trip through the wormhole, closely resembling the effects used in *Stargate*.

Once on the other side of the wormhole, the crew has a disastrous experience on the first planet they explore. One would assume that this ultra-high-tech intergalactic wormhole-capable craft would have a few sensors, telescopes, probes and radar that could have told the crew not to bother with a world that is totally unsuited to settlement. Didn't the engineers watch *StarTrek*? I guess the film's writers must have felt that they needed a calamitous plot element at this point. Then the crew visits a planet situated near the black hole. There's no star, so where can life-sustaining visible and infrared radiation come from? Any of those wavelengths generated by the accretion disk around a real black hole would be accompanied by ultra-intense X-ray radiation that would instantly incinerate any life. There's no technological *deus-ex-machina* fix such as might be found in the super-resistant skin of spacecraft constructed by the Puppeteers, a race created by sci-fi writer Larry Niven for just this situation. So the problem is just ignored. And why would anyone think that a planet near a black hole is worth colonizing? That's like building your new home next to a nuclear waste dump. It just makes no sense.

A trip into the black hole is the climactic element of the plot. The graphics are pretty good for this part of the film. Cooper heads in, gets plenty of bumps, and ends up in a strange place that is referred to as a "tesseract", which is a 4-dimensional cube. Think of a one dimensional line. Extend it into a second dimension, and you get a square. Extend the square into a third dimension, you get a cube. Extend the cube into a fourth dimension and you get a tesseract, sometimes called a hypercube. We can draw a representation of it, but not the thing itself. The mathematics and geometry of multiple dimensions are not considered all that difficult, but we can't conceive the fourth dimension visually. The properties of this particular tesseract turn out to have a lot to do with his daughter's room back on Earth.

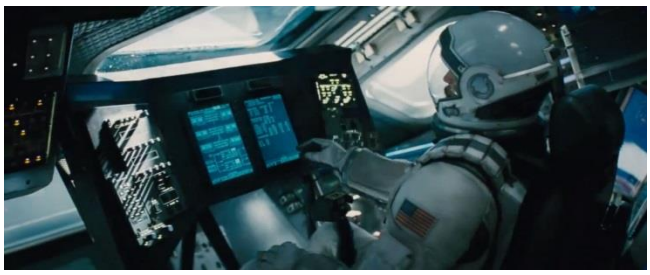


Conventional representation of a tesseract

Now at this point in the plot, it is revealed that the wormhole was not created by an alien race, as first assumed, but by descendants of humanity that live so far in the future that they have conquered the dimensions of space and time and they can manipulate gravity. They presumably can move about in time (or somehow allow us to do so) the way we move in space. The entry point to this phenomenon is the inside of a black hole, which characters in the movie point out several times (correctly) is a region whose structure and properties are completely unknown to us. Current theories about black holes suggest that the properties of space and time may be interchanged

within the hole, but there's no consistent mathematics to say exactly what happens.

In his discussion of the plot of *Interstellar* in an online video, Neil deGrasse Tyson points out that we are free to move about in the spatial dimensions, but we're "trapped in the present" in the time dimension. If one could somehow travel in a higher dimension (whatever that really means), it might be possible for us to move about in the time dimension. Upon this concept hinges the resolution of *Interstellar's* plot. Cooper sends those ghostly signals across space and back in time to his 10-year old daughter. Then he sends signals to her when she is 34, now an accomplished theoretical physicist, which allow her to find a solution to humanity's impending extinction.



But therein lies the rub. What we have here is the famous Grandfather Paradox. You can't go back in time and kill your grandfather, thus ultimately preventing your birth, since then you wouldn't be here to go back in time to kill your grandfather. In the *Interstellar* case, it's the reverse: your gravity-manipulating super-evolved human descendants can't create a wormhole in their past (your present) to prevent your extinction if you weren't going to survive to eventually beget them in the first place. Time travel into the past is always contradictory, and that's why it is, I am sure, impossible. The inviolability of logic must prevail.

Time travel solely into the future does not at first appear to create the same logical paradox. After all, we are all traveling forward in time, from one Planck interval (10^{-43} seconds) to the next. It might make sense to enter another dimension and move forward in time, jumping many Planck intervals, but the mechanism ought to allow us to move backwards as well since the laws of physics are absolutely symmetric with respect to time. In fact, one of the proposed solutions to the unification of quantum mechanics and relativity, the Wheeler-DeWitt equation, has no time term at all, leading to a suggestion that time may not exist at a fundamental level in the universe. It may be an emergent property of reality, rather than being inherent in reality itself. But as we've seen, moving backwards is logically forbidden.

Time is indeed one of the great mysteries: we call it a dimension, but we really don't understand why it is different than the other dimensions, why it inexorably moves in one direction and traps us in spite of the time-independence of physics. Even though Einstein showed that time is relative, that moving observers don't agree on when events occurred and that clocks run slower in strong gravitational fields or at high velocity, time *never* moves backwards. Richard Feynman, in his formulation of relativistic quantum field theory, noted that for the theory's purposes anti-particles can be considered to be regular particles that move backwards in time, but he never claimed they *actually* move backwards in time. Conceptual time reversal allows the construction of "Feynman diagrams" and permits the necessary calculations.

This got me thinking about Noether's Theorem, one of the great contributions to physics in first half of the 20th century, along with quantum mechanics and special and general relativity. In (very) simplified terms, Noether's theorem states that for any physical system described by a symmetry, there will be a corresponding conservation law. For example, the outcome doesn't change when an experiment is moved 5 feet to the right. This is symmetry with respect to translation in space and the quantity that is conserved is momentum. For an experiment done 5 minutes later, the results will also be the same; symmetry with respect to time is associated with the conservation of energy. For the symmetry of rotation around an axis, the con-

served quantity is angular momentum. Symmetries and conserved quantities are critical to the Standard Model of particle physics. What if *logic itself* is described by a symmetry? What would be conserved? Maybe there is something called the "conservation of the direction of time." We live in a mathematical world. Bertrand Russell and Alfred North Whitehead showed in their monumental *Principia Mathematica* (1910-1913) that all mathematics can be derived from logic. There's something special and critical about logic. It seems to me that there must be an axiomatic logical truth underlying all of reality. Does logic exist only in our minds, or is it something that's in the fabric of reality, something we've discovered and not invented? Perhaps the irreversible direction of time is the conserved quantity resulting from the symmetry of logic (True and False always being exclusive). Well, it's a stretch, but why not?

Science fiction has enthusiastically employed time travel for many of its plots. It's a charming device that can motivate a plot in unique ways, particularly effective in film. For example think of Kirk and Spock saving the whales in *Star Trek IV*, Malcolm McDowell as H.G. Wells chasing Jack the Ripper in modern San Francisco in *Time After Time*, and Terry Gilliam's dark satire *12 Monkeys*, among many others. One of the original time travel novels was Mark Twain's *A Connecticut Yankee in King Arthur's Court*, which probably accounts for Twain's appearance in a 2-part *Star Trek Next Generation* episode in which the crew travels to the turn of the (20th) century San Francisco.

Black holes were first conceived by the 18th century English clergyman and philosopher John Michell. The mathematics of black holes has been studied since the late 1930's. One of J. Robert Oppenheimer's main contributions to theoretical physics was his derivation of the existence of black holes (though he didn't use the term) in a paper published in 1939 As shown mathematically by others, to an observer outside the black hole, someone reaching the event horizon would be smeared out on the horizon's surface and the radiation from the smearee would be increasingly redshifted and dimmed, a process that would actually take an infinite amount of time to complete. Paradoxically, the individual would notice nothing different as he passed the event horizon, except of course he would have been X-radiated and tidally spaghettified (this is now an actual scientific word). These seemingly contradictory yet simultaneous events are two of the remarkable outcomes of general relativity and black hole thermodynamics. These difficulties are ignored in *Interstellar* and the plot doesn't include a quasi-scientific "out" such as might be tendered in *Star Trek* ("Captain, if we reverse polarity of the antimatter warp coils, we can generate a tachyon-emitting stasis field from the interossiter that will neutralize the verteron rays!" "Make it so.")

There are a few low-level errors, as always creep in to movies with a lot of newly-imagined technology. For example, the intelligent, conversational robots that are an important part of the plot just can't walk in a bipedal fashion as they are shown to do several times in the film. Bipeds can swing their non-weight-bearing leg forward because they tense muscles on the outside of their standing leg. This functionally shifts their center of mass over the standing leg (balancing weight with tension). If they weren't able to do that, they'd fall to the side as soon as the swinging leg left the ground. I don't see how a robot could do that. Maybe they have been given the Trekkie hyperscience that the rest of the plot is denied.

By the end of the movie, plot complexities fly at you faster than cosmic rays, although there is some poetry to how the emotional elements of the story are tied together. Of course, no matter how prolix the plot turns or how stressed the physics or how loud the soundtrack, *Interstellar* is light years better than that other black hole movie, Disney's *The Black Hole*,

which I suspect we will all agree is cinema's black hole, worse than *Star Trek: The Movie* and maybe even *Plan 9 from Outer Space*.

I'm not insensitive to the depiction of intense, struggling relationships, but if I want to see a challenged father-daughter bond portrayed with profound passion, I'll stick with Verdi. If you want a "true science" space film, see the 2013 gem *Europa Report*. It's not only scientifically accurate, it asks a profound question that's actually capable of being answered. Consider *Forbidden Planet*, which mixes human motivations and capabilities with alien technology, with a monster that's a credible product of the Freudian mind infected with limitless power, yet it shows how humans can prevail. Or go back to Stanley Kubrick's magisterial *2001: A Space Odyssey*, which is not just about plausible science (until the writer, Arthur C. Clarke, moves the plot into symbolic realms) but has poetic and metaphoric content far more profound than *Interstellar*. *2001* is about the relationship of the mind to the body, the problem of mortality, and how the mind might evolve to exist free of corporeal constraints. That's why there are so many scenes of people eating, references to bodily functions (such as the zero gravity toilet) and even celebrations of birthdays. The *andante ma non troppo* pacing of *2001* is far more to my taste than the long bursts of frenetic (and loud) *presto* action in *Interstellar*. For sure it's not for everyone: many people find *2001* to be interminably slow and arcane, and the ending can be baffling. It doesn't have any interest in depicting intense emotional relationships. *De gustibus non disputandem est.*

Interstellar thankfully lacks any mention of religion, and so it avoids the trap that Carl Sagan succumbed to in *Contact*, which is to think that it's the obligation of science to give religion equal time when remarkable and unexpected things happen. In *Contact*, Sagan inserts the smarmy character of the Christian philosopher Palmer Joss (played by none other than Matthew McConaughey) who I find much too unctuous, self-assured and disruptive. Maybe McConaughey is doing penance (a fine Christian act) for playing this self-important fabulist in *Contact* by taking the part of the instinctively rational Cooper in *Interstellar*. If we are ever to solve our existential problems, it will be through science, a more deeply social and even spiritual enterprise than most people appreciate.

Finally, do we really want to see humanity reaching for the stars out of desperation? Shouldn't our motivation for such an epic quest be one of progress rather than mere survival? Of striving and not fleeing? To that end, and the end of this review, I give you the finale of the classic film *Things to Come*, based on an H.G. Wells novel. It's a speech by the government leader Cabal (Raymond Massey) after his daughter and his friend Passworthy's son leave on the first space flight to the moon. There's a pessimistic note in an otherwise optimistic scenario: the movie sets the first moon shot in 2036, the plot depicting a longer period of societal disruption after a global war, clearly impending in 1936 when the film was made, than actually occurred. As in *Interstellar*, there's a strong neo-Luddite anti-progress mentality among the general populace, but Cabal is heir to a tradition of using science and technology for social good (the movie's prime message) and he ensures that progress prevails.

PASSWORTHY: My God! Is there never to be an age of happiness? Is there never to be rest?

CABAL: Rest enough for the individual man. Too much of it and too soon, and we call it death. But for MAN no rest and no ending. He must go on--conquest beyond conquest. This little planet and its winds and ways, and all the laws of mind and matter that restrain him. Then the planets about him, and at last out across immensity to the stars. And when he has conquered all the deeps of space and all the mysteries of time--still he will be beginning.

PASSWORTHY: But we are such little creatures. Poor humanity. So fragile--so weak.

CABAL: Little animals, eh?

PASSWORTHY: Little animals.

CABAL: If we are no more than animals--we must snatch at our little scraps of happiness and live and suffer and pass, mattering no more--than all the other animals do--or have done. [He points out at the stars.] It is that--or this? All the universe--or nothingness.... Which shall it be, Passworthy? Which shall it be?

Keeping an Eye on Storms and More

By Kieran Mulvaney

In late July 2013, Tropical Storm Flossie barreled furiously toward Hawaii. The question was not if it would strike, but when and where it might do so.

During the afternoon hours of July 29, forecasts predicted landfall later that week on the state's Big Island; however, by the time residents of the 50th state awoke the following morning things had changed. NOAA's Central Pacific Hurricane Center warned that the islands of Oahu, Molokai and Maui were now at a greater risk.

This overnight recalculation was thanks to the Day/Night Band viewing capabilities of the Visible Infrared Imaging Radiometer Suite, or VIIRS, on board the Suomi National Polar-Orbiting Partnership (Suomi NPP) satellite. VIIRS is able to collect visible imagery at night, according to Mitch Goldberg, program scientist for NOAA's Joint Polar Satellite System (JPSS), of which Suomi NPP is a part. That means it was able to spot some high-level circulation further north than expected during the nighttime hours. This was an important observation which impacted the whole forecast. Without this forecast, said the Hurricane Center's Tom Evans, "we would have basically been guessing on Tropical Storm Flossie's center."

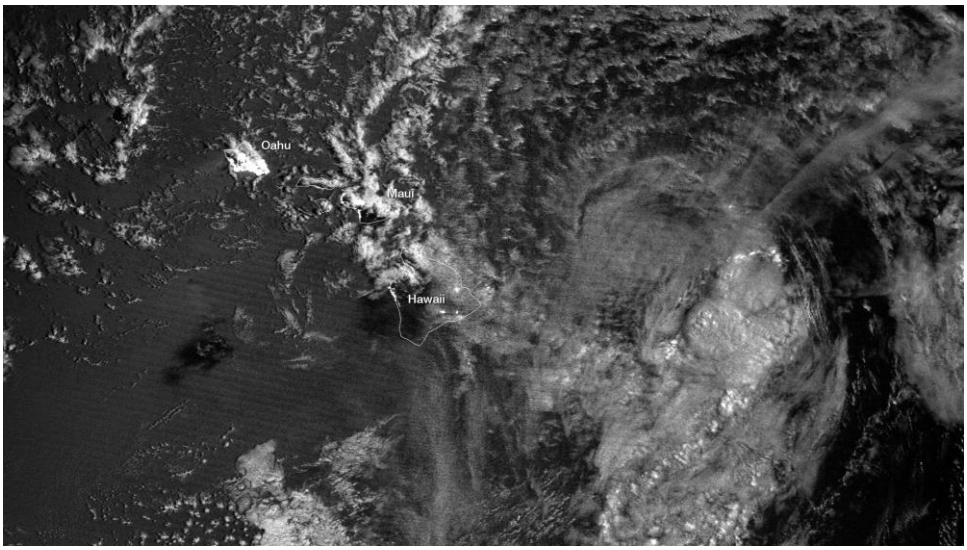
Polar-orbiting satellites, like Suomi NPP and the future JPSS-1 and JPSS-2 (scheduled for launch in 2017 and 2021, respectively), sweep in a longitudinal path over Earth as the planet rotates beneath them—scanning the globe twice a day. VIIRS, the imager that will be aboard all the JPSS satellites, images 3,000 km-wide swaths on each orbit, with each swath overlapping the next by 200 km to ensure uninterrupted global coverage. This high-resolution, rapidly updating coverage allows researchers to see weather patterns change in near real-time.

Instruments on Suomi NPP allow scientists to study such long-term changes too—things like, "the patterns of sea surface temperature, or coral bleaching," says Goldberg. They are even used by the World Bank to determine how much energy is burned off and wasted from natural gas flares on oil drilling platforms.

While scientists are excited by the JPSS series' wide range of capabilities, the ability to address pressing immediate concerns is, for many, the most tangible value. That was certainly the case in July 2013, when thanks to Suomi NPP, authorities had ample time to close ports and facilities, open shelters, activate emergency procedures, and issue flash flood warnings. Despite heavy rains, high surf, and widespread power outages, accidents and injuries were few. By the time the storm passed, Hawaii was soaked.

But it was largely unharmed.

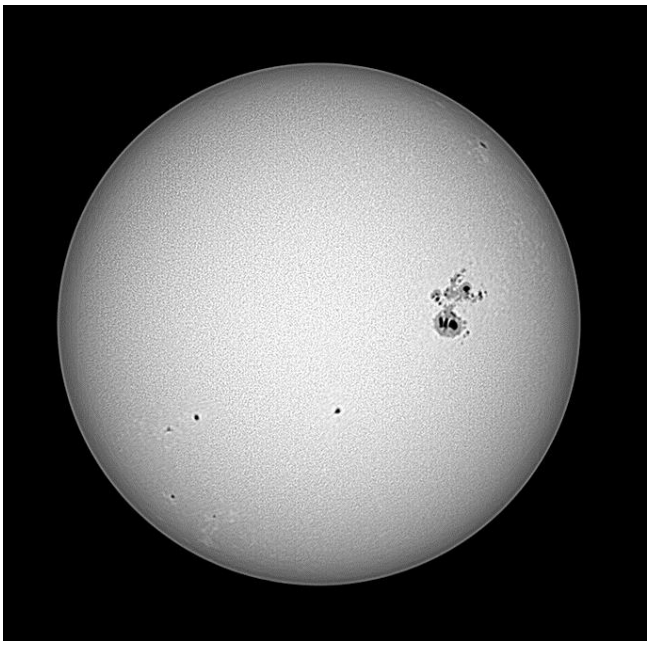
Learn more about JPSS here:
http://www.jpss.noaa.gov.
Kids can learn all about how hurricanes form at NASA's Space Place:
http://spaceplace.nasa.gov/hurricanes

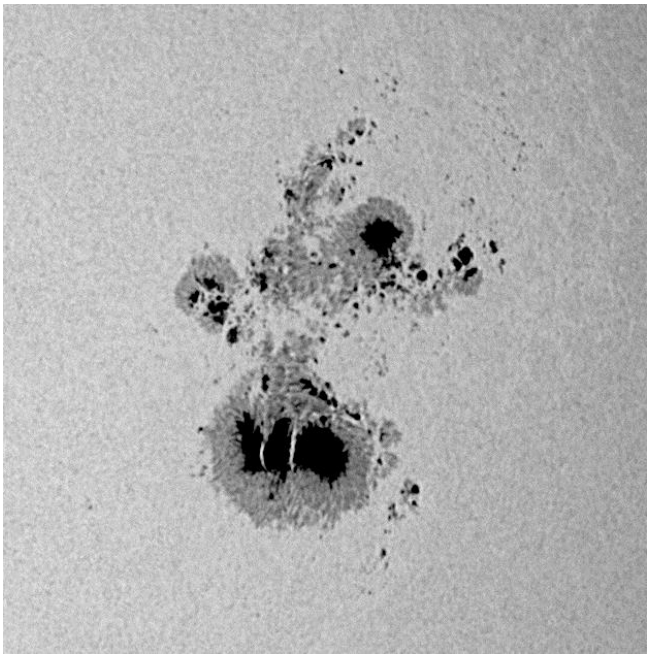


S-NPP captured this image of Tropical Storm Flossie heading toward Hawaii using its VIIRS Combined Day-Night Band sensor. Credit: NOAA.

Westchester Amateur Astronomers

Astrophotos





Active Region 2192 passed across the face of the sun during the last 10 days of October. This monster sunspot, the largest of the current solar cycle, was over 100,000 kilometers across and was associated with coronal mass ejections and M-class flares.

These images were taken the morning of October 25th with a Stellarvue 80mm f/6 achromatic refractor with a Baader mylar filter on an iOptron Minitower mount. I used a Celestron Skyris 445 monochrome camera with an Astromik 12 nm hydrogen alpha filter in front of the camera to boost contrast and sharpness. The full-disk image used a 0.5x focal reducer to get the whole solar disk on the 1/3" sensor, while the detailed image was taken with a 2x Barlow. Each image was made from the best 20% of about 5000 1280x960 frames @ 30fps, stacked with AutoStakkert!2, wavelet processing with Registax 6 and final cropping and contrast balance in Photoshop Elements.

--Larry Faltz

Running Man

This image of the Running Man nebula (NGC 1973/5/7) is courtesy of Olivier Prache. Notes Olivier: the image is a work in progress, luminance part only for now taken off and on over the past 2 weeks. 3 hours with my Hyperion 12" and processed with Ccdstack and PixInsight.

The Running Man is a reflection nebula in Orion.