Santa Monica Amateur Astronomy Club

June, 2016

The Observer

UPCOMING CLUB MEETING: FRIDAY, JUNE 10 (7:30 PM)

This meeting is yours—updates, discussion, astronomy talk, planning, Q and A...it's your call this time around! You get to (ahem...) vote! (You can see why it's a bit open, below.)

"The Old Fire", Calabasas. Just a few hours old at this point, actually. Did you know that the Earth is the only planet where you can light a match? Can anyone guess why? See next page! (Photo by editor, from home.)

INSIDE THIS ISSUE

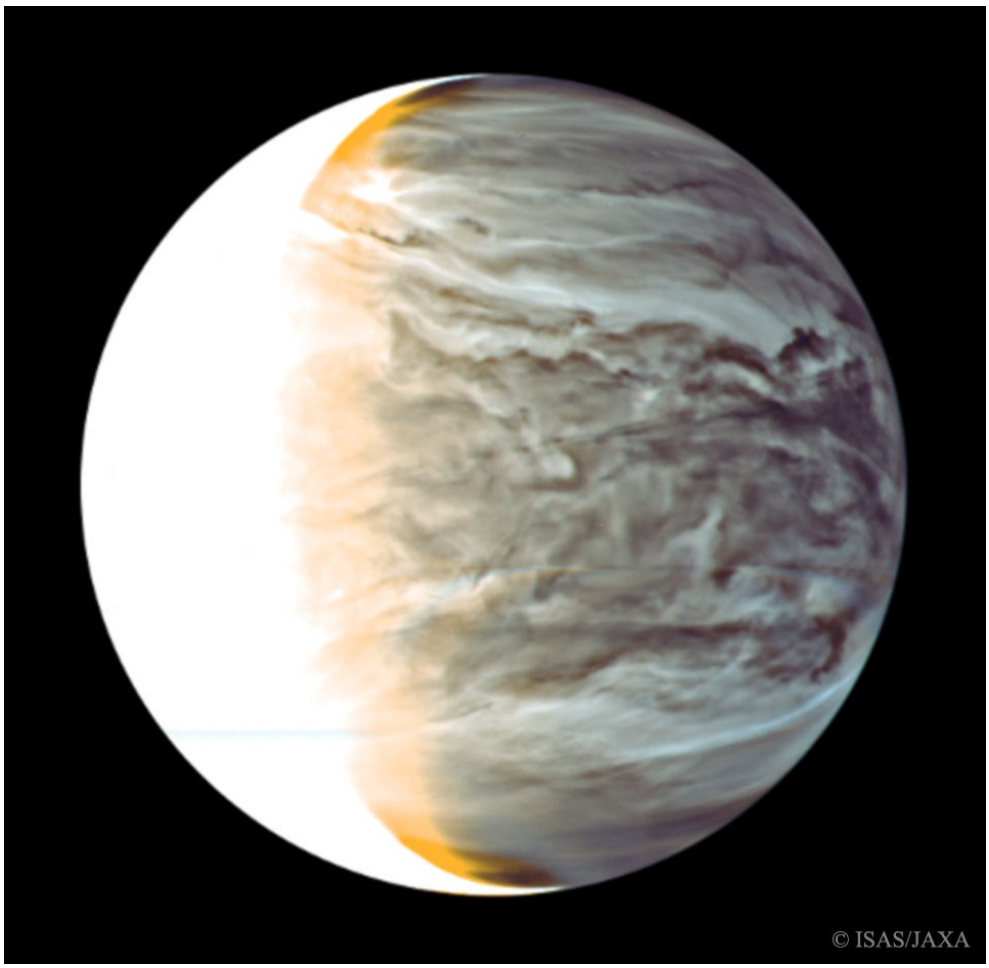
OUR MEETING SITE:

Wildwood School
11811 Olympic Blvd.
Los Angeles, CA 90064

Free parking in garage, SE corner of Mississippi &Westgate.

COVER ILLUSTRATION:

If you're wondering why the bulletin's a bit rushed and the meeting's a bit informal...here's the view from my home last Saturday. No damage, no harm done—thanks to a bit of luck and some heroic efforts by our firefighters. Had to move a few things out of harm's way, though...—ed.



Can't light a match on Venus! It's super-thick carbon dioxide atmosphere is already fully oxidized, and won't burn. Because of these clouds, Venus reflects about 70% of the incoming sunlight, compared to Earth's 30%. This means that Venus should actually have colder surface than Earth's, with an average temperature of –40°F! At an actual 860°F, Venus has 900°F of greenhouse warming. (Earth's values are 0°F and 59°F respectively. For Mars, it's about –80°F and –75°F, for a mere 5°F of greenhouse warming.)

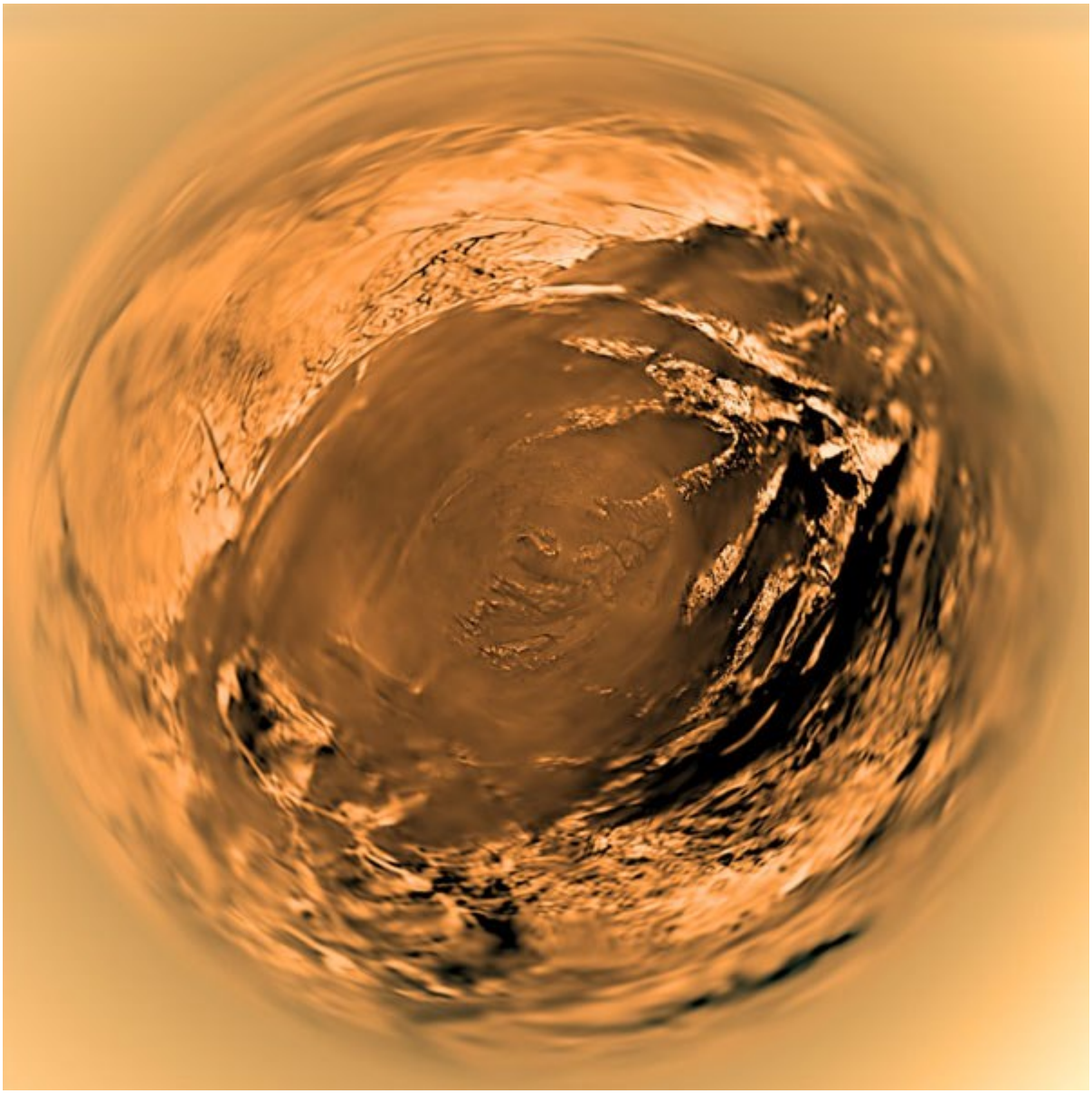
Japan's Akatsuki satellite, also known as the Venus Climate Orbiter, has finally arrived! After a jammed valve prevented it from achieving Venus orbit in 2010, engineers skillfully retargeted it. Now, after six years of interplanetary travel, it has arrived in a 9 day orbit about Venus and, as of May 2016, it is finally beginning its long-awaited science operations.

Infrared images of the atmosphere, like this one, are already surprising scientists, who are seeing unexpected patterns in the cloud belts.

Venus' atmosphere super-rotates: It is moving far faster than the planet, an anomaly in our Solar System.

Although the surface pressure is around 92 atmospheres, with 860°F temperatures, some high altitude regions of the atmosphere are actually quite comfortably habitable. We have much to learn from this exciting mission.

TRIVIA: Before the word "Venusian' became popular, the proper term was considered to be "Cytherean", as Venus/Aphrodite arose from the foam near the island of Cythera. Why go there? The strict adjectival forms are "Venerean" and "Aphrodisial". See the issue?



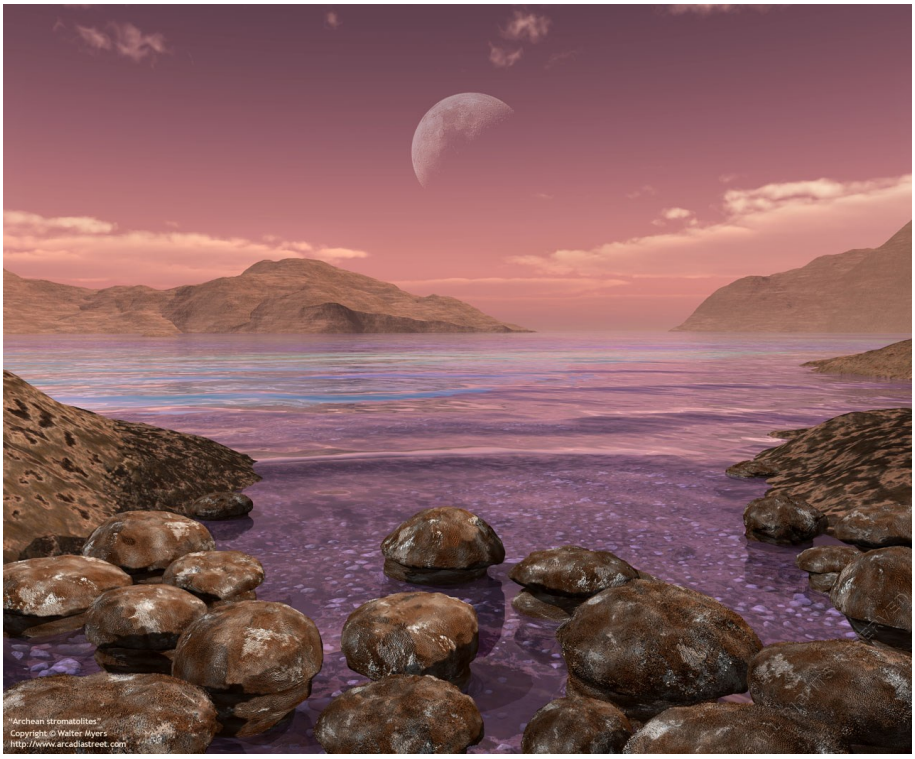
Can't light a match on Saturn's largest satellite, Titan! The air is over 98% molecular nitrogen, but the remaining gas consists largely of combustible methane (CH_4) and explosive hydrogen (H_2). So why won't this reducing atmosphere, rich with cooking gas (methane and ethane come out of your gas burner) simply explode (oxidize) if lit? No oxygen! No carbon dioxide either: At the –290°F surface temperatures, all the CO_2 is locked up as ice.

It now looks as if those big 'sand' dunes really aren't ice, but meters and meters and meters of organic goo—tholins and various hydrocarbons. And, while the lakes are neat, some JPL researchers are convinced that the deposits seen around some of the lakes are primarily benzene, a notorious carcinogen.

Another item: The temporary 'island' seen in one of the lakes may actually be rough water, with waves looking solid in the radar image. Stay tuned—we may have an upcoming talk on this!

Titan's atmosphere is transparent to infrared but opaque to visible light—giving it a remarkable "reverse greenhouse effect, that cools instead of warms.

So, what makes Earth's atmosphere uniquely combustible?



The answer, of course, is LIFE. Life's organic processes drive our ecosystem way out of equilibrium, allowing both oxidized and reduced compounds to coexist far, far from equilibrium. When the Curiosity rover found minerals in different oxidative states, it was taken as a good sign that there was at least a possible pathway to life there, once upon a time.

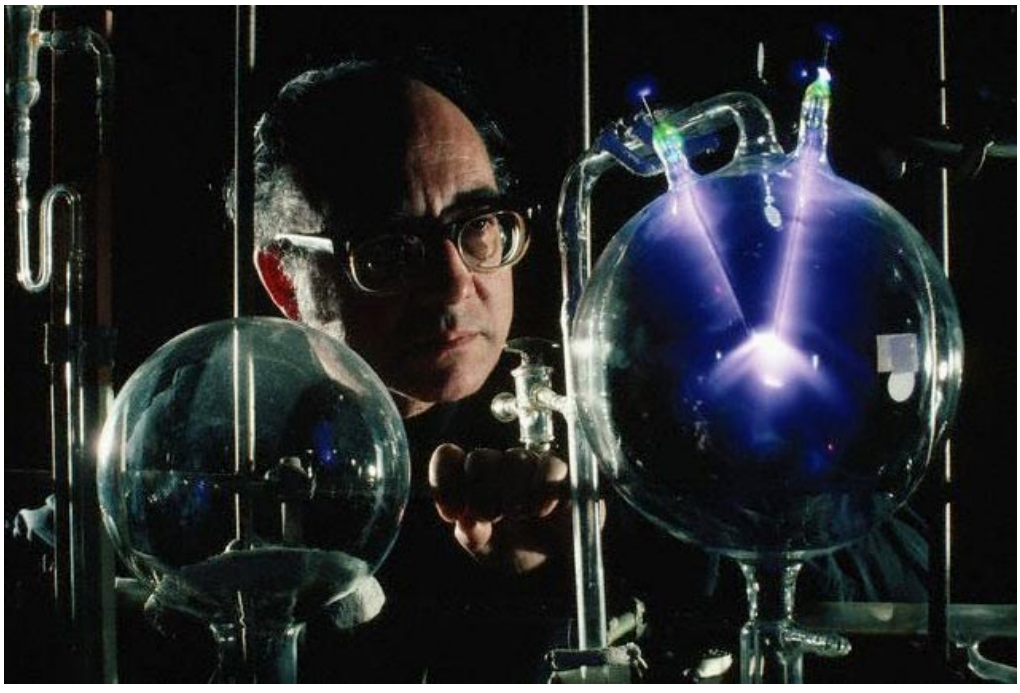
Above (illustration) and below: Stromatolites. These appear to be rocks, but they are actually microbial mats, and the oldest macroscopic signs of life on earth. Bacteria (aerobic on the outside, anaerobic on the inside) piled up in layers, with sediment and secretions holding it all together. About 3.8 billion years ago (we think) the bacteria were all purple anaerobes. About 3.5 billion years ago, the oldest microfossils appear (this is a debated, but still popular, date). Possibly 2.7 billion years ago, green cyanobacteria began releasing oxygen through free photosynthesis.

Today, we only see stromatolites growing in rare, hypersaline environments, such as Shark's Bay, Australia and parts of Baja. Once, they dominated life on earth, but modern herbivores will graze on bacterial mats before they really have a chance to develop.

Right: A banded iron formation. Once cyanobacteria began releasing oxygen—not much happened! Life was flat 2.7 billion years ago—other bacteria would quickly suck up the oxygen. Once they had their fill, the minerals in the ocean began sucking up the free oxygen. The green, iron filled oceans turned blue as iron oxidized, sank and compressed into these red "banded iron formation" rocks. Such rocks are found all over the world—but why in layers? Did the process happen in fits and starts? There are still a lot of mysteries from the early eons of our world.

Below: Stan Miller, of the famous Miller-Urey Experiment. Lightning sparks a primitive, 'reducing' atmosphere of ammonia and methane, and is cycled again and again over water. Lightning and bacteria 'fix' nitrogen into complex forms today, but Miller found amino acids accumulating in his 'primordial soup'. (Nucleotides, with their many carbon atoms, are much tougher to make this way.)

We now think that the early atmosphere may have been more neutral, rich in CO_2 and N_2...but no one knows for sure. The oldest rocks are ~4 billion years old. Tiny zircon crystals give us some information from as far back as 4.4 billion years. The earth formed about 4.56 billion years ago.



Gallery from a busy month. (Photos by the editor.)

May 21: The Space Shuttle External Tank dominates Vermont Avenue, on its way from Marina Del Ray to its home at the California Science Center. It will be mated to Endeavour, and both will be displayed vertically. Unlike Endeavour, this never actually flew in space—the ET's were the one major non-reusable shuttle part, and after the Columbia accident, this tank was used to investigate the foam problems (you can still see some places where the foam was torn away). Built in 2001, it survived Hurricane Katrina in 2005, but this "lightweight" tank was replaced with the "superlightweight" version, which used an aluminum-lithium alloy to shed several thousand pounds. So, here it is, after a long journey from N'Awlins. (Where?)

Length: ~153 feet
Diameter: ~27 feet
Weight (empty): 66,000 lbs
Weight (full): 1.68 million pounds

Notice what passes for "lightweight"!

FILLER' UP!

Moving at a walking pace, past Vermont and 52nd Streets.

Now, that's a fuel tank!

Friday, May 27: Re-aluminizing the great 100” mirror at Mt. Wilson

Here’s the mirror of the 100” telescope—the same one used by Hubble to show that the Milky Way was one galaxy among many—stripped of its aluminum coating and ready to go into the vacuum chamber to get its shiny, new film. The mirror was cast on December 31, 1907—and looks as clean as the day it was made. Those markings aren’t external flaws—they’re the oxygen bubbles deep inside, from the original pouring. One DARE not speak here—I am holding my breath during the photo! The mirrors get a new coat about every other year, on average.

After drying overnight, the mirror went into the vacuum chamber (pictured) at about 10 am on Saturday. It takes 5-8 hours to achieve a good vacuum, depending on the humidity and other imponderable factors. (“Vacuums are notoriously tricky,” notes Larry Webster, the observatory’s expert on these procedures.)

Once the vacuum is achieved, aluminum sublimates off hot filaments and coats the mirror (and everything else inside) in just minutes.

The Swirl of a Great Mirror

The mirror was cast at St. Gobain in France—the glassworks established by Louis XIV for his great Hall of Mirrors at Versaille. This was the only facility in the world that had an oven big enough to handle to the 9,500 lb glass, made of the same basic ingredients as plate glass in your windows—silica (silicon dioxide, the founder; basis of the glass), soda (sodium carbonate, the flux; to lower the melting point) and lime (calcium carbonate, the stabilizer; to lower absorption of water vapor and other un-desirables).

Although the over was big enough to melt the glass, the ladle wasn't big enough to pour it all at once. The three separate pourings into the mold created bubbles, which horrified the Mt. Wilson astronomers when they first saw these swirls of gas inside! After eight attempts to get it right, this one (we think it's the third try) seemed the best that could be done—and the bubbles, wholly internal, may actually have helped to strengthen the glass.

Riverside Telescope Makers Convention, Big Bear: 2016

Robert, with Dave, who now lives in Lake Elsinore. Dave is retiring, so we may be fortunate enough to see more of him.

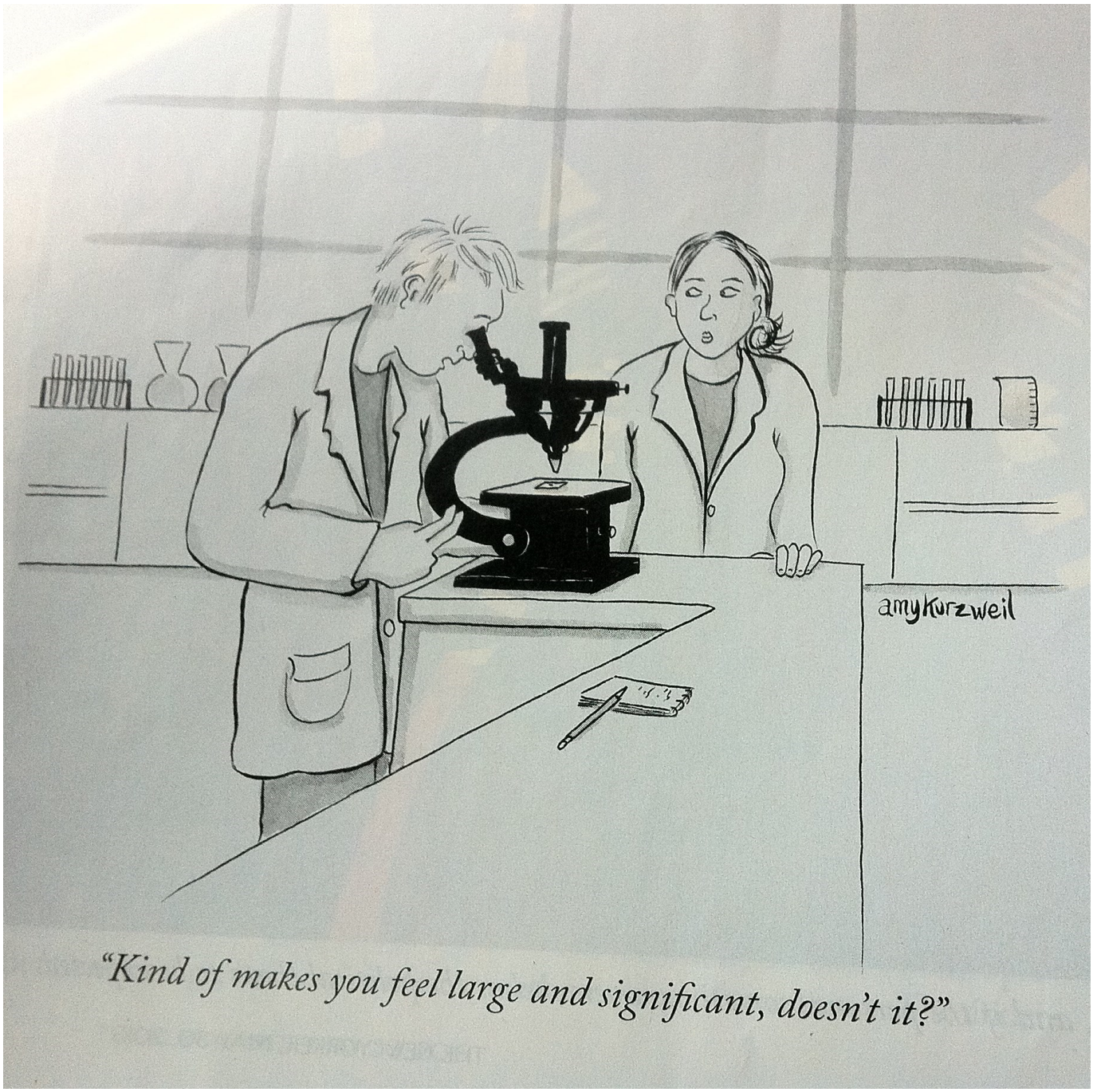
Congratulations to Jim and Iria's kids, who won a telescope!

Mike and Robert at the Big Bear Solar Observatory. This is the world's most advanced solar telescope, a 1.6 meter (63") Gregorian f/52. Go to the BBSO website to see the spectacular images.

The lake level was so low that we could actually walk right up to the observatory—its locked gate up on the causeway being of no use! Instead of being chased away, however, we got a warm welcome and an impromptu tour.

On the next adventure, please join us!

Parting thought for the day...



Courtesy: New Yorker Magazine