Santa Monica Amateur Astronomy Club

September, 2015

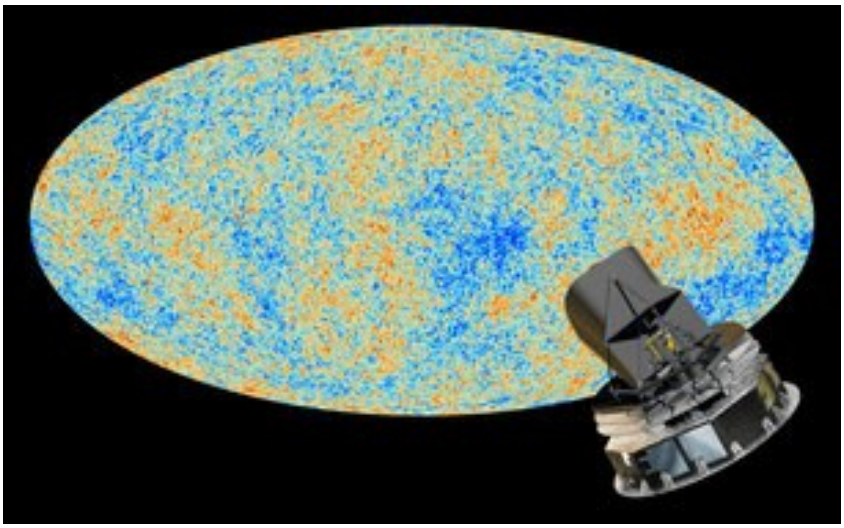
The Observer

UPCOMING CLUB MEETING:
FRIDAY, SEPTEMBER 11, 7:30 PM

Topics:

Updates on Pluto, space program and more!

Speaker: Jim Bartlett and club



New results from the Planck Satellite give us our best view yet of "the oldest light in the universe."

INSIDE THIS ISSUE

OUR MEETING SITE:

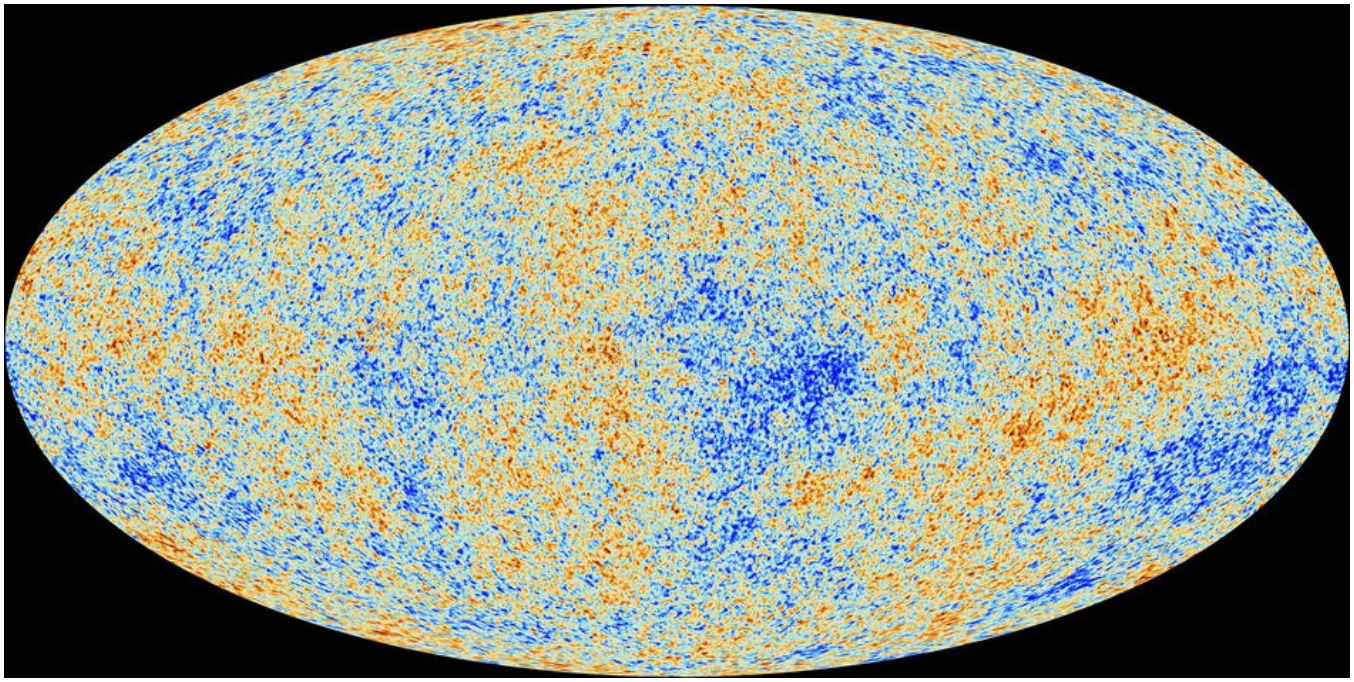
Wildwood School
11811 Olympic Blvd.
Los Angeles, CA 90064

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

"The Observer" would be delighted to accept submissions from club members. Co-editors would also be welcome. See one of our club officers at the next meeting!

The Planck Spacecraft Weighs In On the Early Universe

Staring out at "the oldest light in the universe" from its looping orbit near earth's L2 Lagrange Point, the Planck Satellite has refined observational cosmology to a new degree of precision. The satellite was launched in 2009, and although it was decommissioned in 2013, the Planck team has been refining its conclusions since the preliminary 2013 report. Because the probe looked at the cosmos in 9 different wavelengths, it has been possible to painstakingly remove most of the Milky Way's foreground radiation from the signal, revealing our clearest picture yet of the very early cosmos.



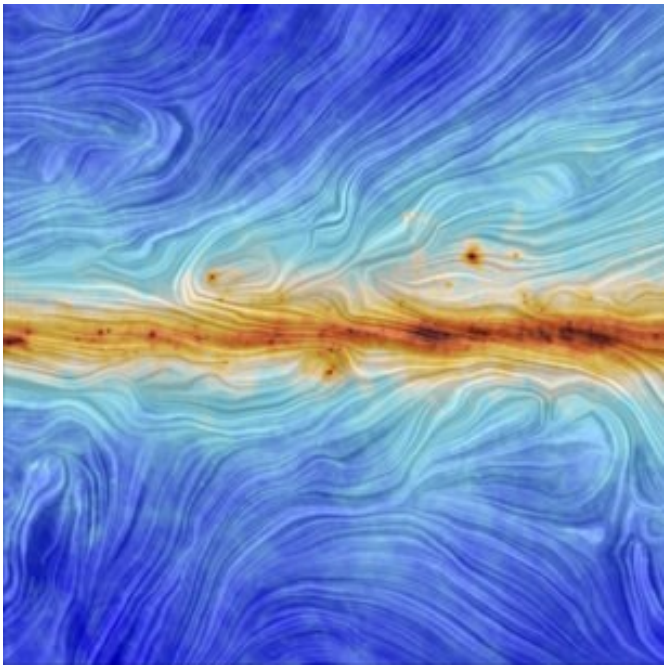
Cosmic Fingerprint

Electrons and protons combined 380,000 years after the Big Bang, as the temperature dropped below 3,000 K, releasing the background radiation seen today. This "recombination age" is sensitive to the amount of Dark Matter, so the figure has shifted a bit with the latest analysis. The temperature map (above) shows that "empty" space is awash in microwaves, with an effective temperature of 2.72548 kelvins. At just a few degrees above absolute zero, it wouldn't reheat your pizza—but it does reveal the condition of the universe as nuclei and electrons finally were able to gather into atoms.

The temperature fluctuations shown by redder and bluer splotches amount to only about 1 part in 100,000. Without any stretching of the color, the map is completely uniform. And, without any Dark Matter, these minute fluctuations would not amplify to form the galaxies and clusters we see today—so this map practically necessitates some kind of invisible mass.

Notably, Planck finds that the larger 'cold spots' (deeper blue) are statistically reasonable, and don't require any new physics. The issue isn't quite settled, so stay tuned!

The Great Dust Up

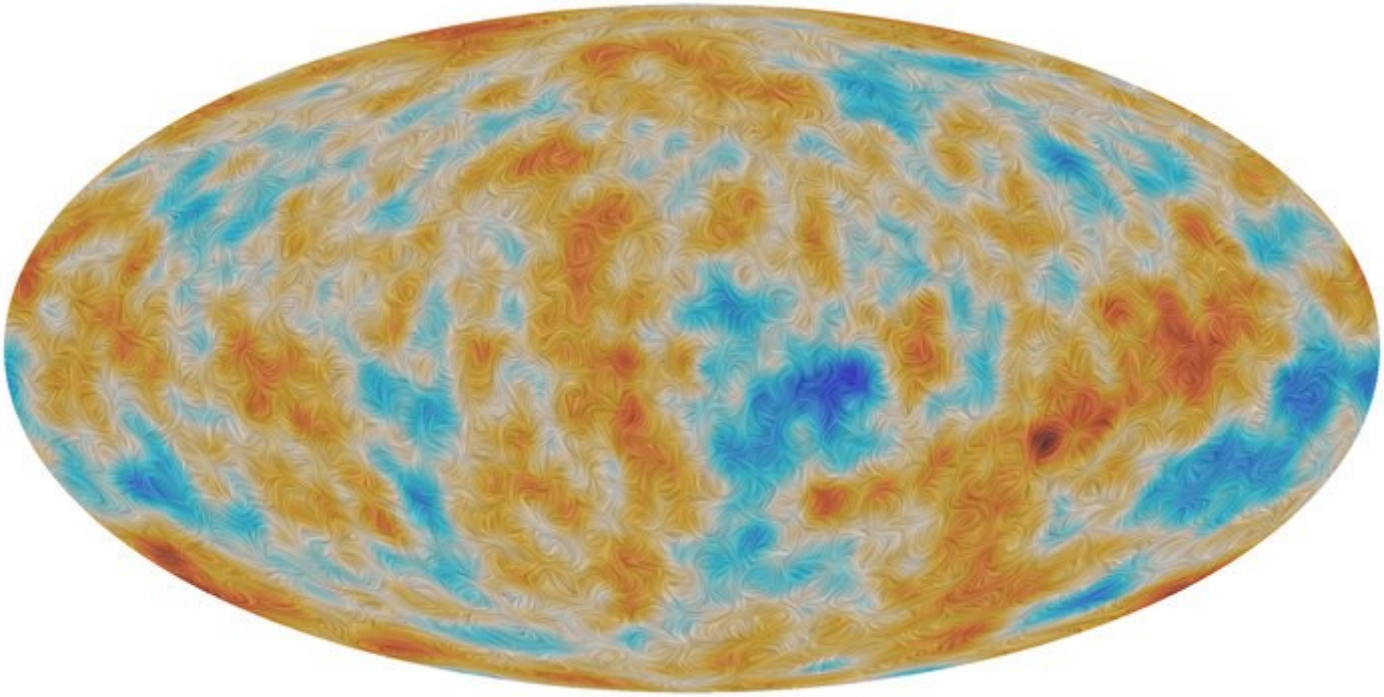


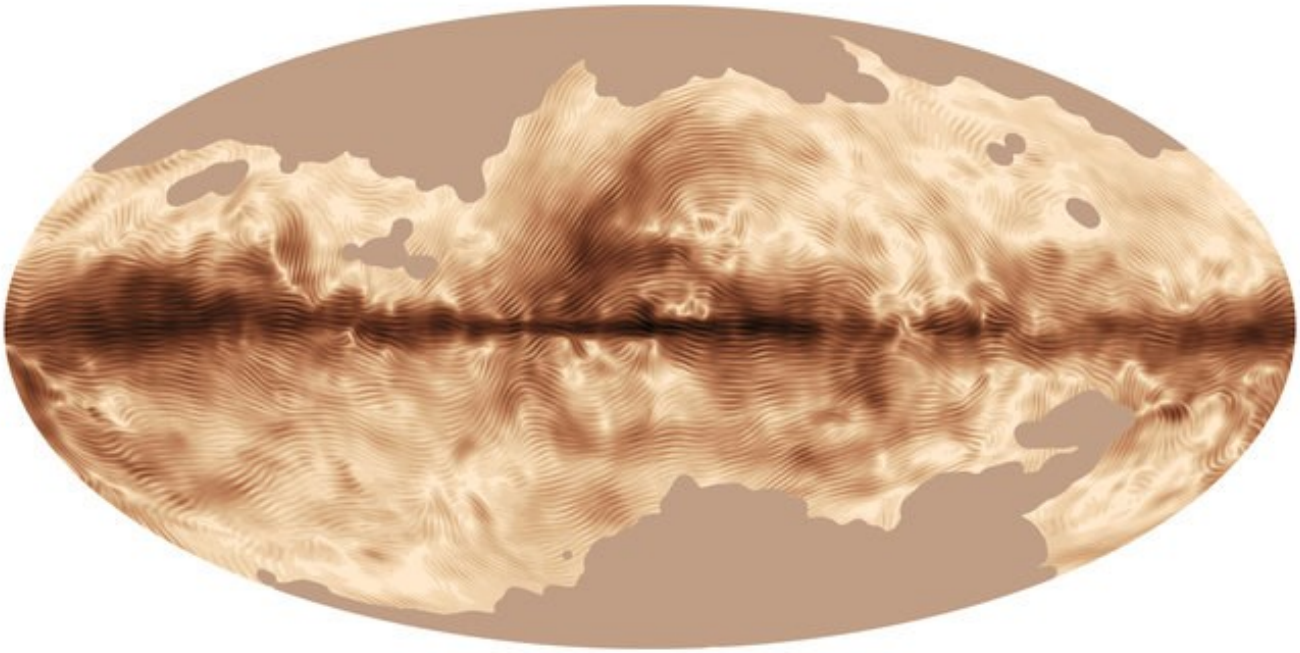
Our club heard a talk by Dr. Phil Korngut of Caltech on the BICEP2 results from the South Pole. The BICEP team thought there was evidence for gravity waves in the Cosmic Microwave Background—but with its multi-wavelength abilities, Planck just sees dust. The larger dust grains line up along the magnetic fields that thread the Milky Way, and polarize the light. "There is no region in the Milky Way where dust is not a factor," according to the Planck team.

More powerful BICEP follow-up searches may yet find evidence of "B Mode" polarization, a hallmark of gravity waves—but the signature of these oscillations in space-time is not yet evident.

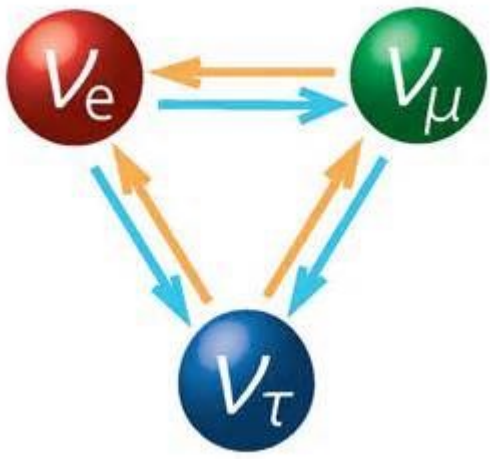
Above: Dust in the Milky Way. The BICEP Team had selected a region far from the Milky Way's central plane. Previous models suggested that dust would not be a serious problem, but now we know: Dust isn't just limited to bookshelves and un-swept floors!

Below: Planck's polarization map, the source of its dust results.





Above: Planck's map of the galaxy's magnetic fields, following from its polarization results. The Planck results are a boon, not just for cosmology, but for the astrophysics of material in our Milky Way. Magnetic fields thread their way through gas clouds and supernova remnants, opening our eyes to new structures in the Milky Way.



A Family Matter

Planck sees evidence for just three types of neutrinos. We already knew about electron, muon and tau neutrinos—so Planck brings reassuring evidence that we have discovered all three basic families of matter, each with its own neutrino.

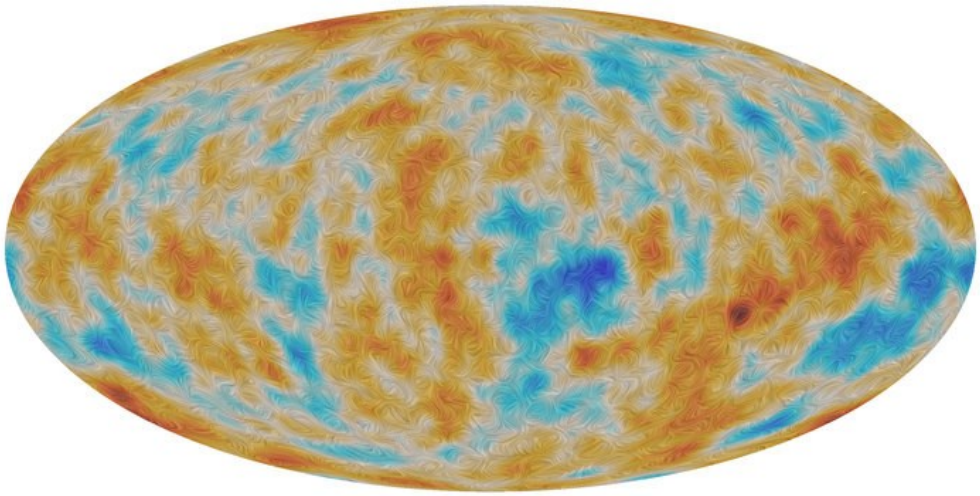
This doesn't rule out new families of exotic particles, some of which are candidates for the mysterious Dark Matter.

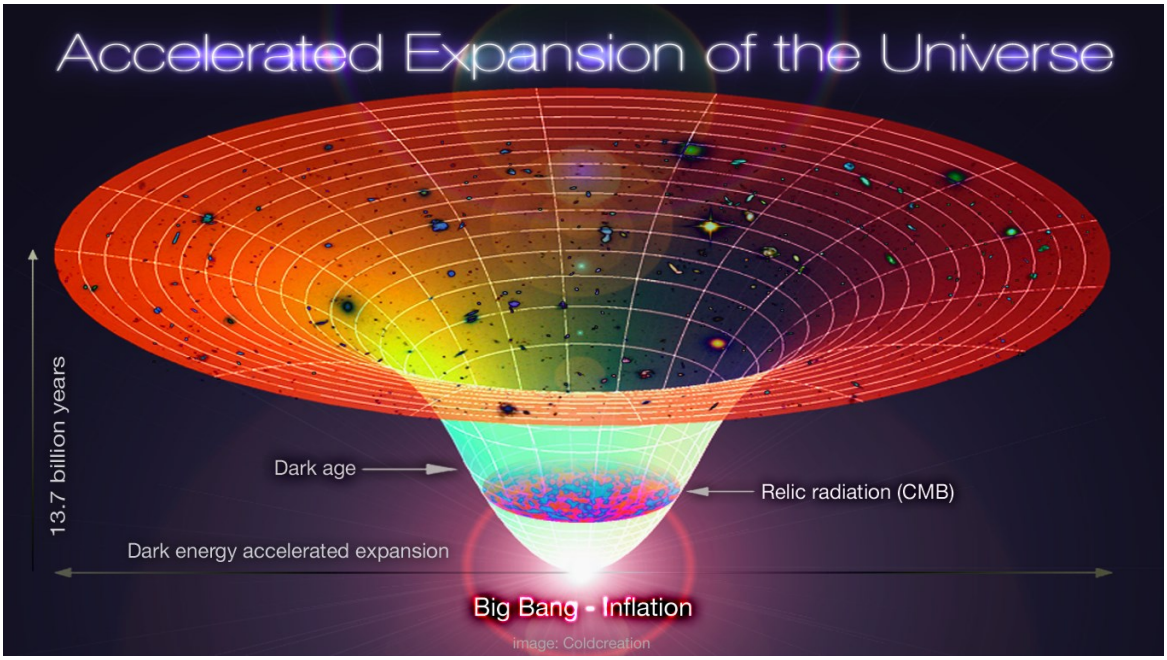
A Big Result: Early Stars Came Just a Bit Later!

Planck's polarization data (shown again below) has changed astronomers' estimate of when the first stars came to light: They made their debut about 560 million years after the Big Bang, rather than the 440 million previously estimated. Stars polarize light, and stronger polarization means earlier formation. Astronomers already knew that the previous studies had large uncertainties, but this is still a significant shift.

So, What's A Hundred Million Years Between Friends (or Theorists)?

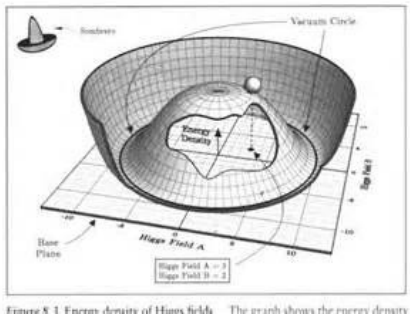
This comes as a relief to many theorists: The earlier age of star formation was difficult to explain, and would have required some rather strange 'invented' objects. On the other hand, think of the exotic, theoretical concoctions that might have invaded the journals!





Planck data shows a universe that's flatter than a pancake!

The Planck results also show a universe that is remarkably flat, with no evidence of large-scale curvature. Earth appears flat because we are seeing such a tiny piece of it. A flat universe (flat in three dimensions) suggests that we may be observing just a minute fraction of what is really out there. Does an infinite universe mean there must be another Santa Monica somewhere out there?



Easy Does It!

Planck results support a basic version of cosmic inflation: One "Inflaton Field", not unlike the Higgs Field, with a slow-rollout. That's slow by Big Bang standards, of course—not like the Segway rollout!

Knew It!

Once again, all the lines of evidence seem to be converging on a consistent picture. As with the Higgs, we seem to have been on the right track.

Note: Myth Busters measured the flatness of a pancake., and determined that Kansas was far flatter.

Space is far, far flatter than Kansas—Jamie and Adam, take note!

And furthermore…

Planck, by looking at the most far-ranging light in the universe, also gives us information on what that light has passed through in the intervening 13.8 billion years. We are getting information on galaxy clusters and their evolution. Planck finds that the Steady State Model of a non-evolving universe, advocated by Fred Hoyle (above) and others, is off by 58 standard deviations. There are a few bigger embarrassments in our current models, but there is no longer an advocacy group for the Steady State among researchers—so we're not likely to hear much about ways around this one!

PLANCK'S UNIVERSE:

Hubble Constant: 67.8 km/s per Megaparsec (recession speed)

Dark Energy: 69.2% of cosmic mass-energy

Dark Matter: 25.9% of cosmic mass-energy

Baryonic Matter: 4.9% of cosmic mass-energy

(Baryonic matter is the stuff we see, hear and eat.)

WHY IS THERE NO NOBEL PRIZE IN ASTRONOMY?

The question has been asked many times: Why is there no Nobel Prize for astronomy? Countless rumors have circulated, some going so far as to suggest a jilted girlfriend who ran off with an astronomer, or a bad experience with an astronomically-inclined relative.

Actually, there isn't much to any of this...

Just Having A Blast

Nobel, a rather enigmatic individual, was involved with three women over his life, but never married. He amassed a tremendous fortune (over $150 million in direct conversion to today's dollars, but effectively worth far more), partly by inventing a way to handle nitroglycerin safely: He soaked it in sodium carbonate, and absorbed it into a form of silica—diatomaceous earth—hence, dynamite.

A Wanderer

Born in Sweden, Nobel spent little time there after his childhood. He lived in Paris, but traveled the world, setting up and monitoring his ninety global factories. When his older (and even richer, having pioneered oil extraction in Russia's Baku Oil Fields) brother died, the press made a mistake: Nobel had the unusual privilege of reading his own obituary. The legacy of his inventions wasn't very flattering—though he had seen the fear of dynamite as a possible means of ending warfare. Liquid nitroglycerin was a killer, being very sensitive to shocks. Dynamite was a life-saver to many. Its other possible uses, however, were evident to the governments that stocked up on it—and, of course, to Nobel.

ALFRED NOBEL

Nobel came from a family of inventors. His father also worked on armaments. Among his father's other legacies: plywood! Nobel was both a pacifist and an armaments manufacturer.

Jumbo shrimp, anyone?

From a mistaken obituary of Nobel:

"The Merchant of Death is dead: Dr. Alfred Nobel, who became rich by finding ways to kill more people faster than ever before, died yesterday..."

Will Power

Nobel's own 1895 will set out the Nobel Prizes in just one long paragraph—and that was it. Nothing more. The Big Three standard sciences of the day (and still, in today's schools) were biology, chemistry and physics. And that's what the prizes were: Physics, Chemistry and Physiology or Medicine. He also had a prize for Literature—Nobel was very well-read, and quite fond of writing long verses. There was one additional prize: Peace. A hopeful legacy for a manufacturer of high explosives.

Say What?

Nobel's relatives, entitled to just a tiny fraction of his estate, were stunned. France, long his home, sued. But the challenges didn't stick. The will was written in Swedish, and his relatives had to make due with their share. Good thing, perhaps: French taxes would have depleted much of the prize money. (As would his relatives!)

Royal Swedish Academy of Sciences

That's All He Wrote?

Nobel put little else in words. The Physics and Chemistry Prizes would be handed out by the Royal Swedish Academy of Sciences—quite a modest institution at the turn of the century, leaving some wondering about its qualifications. The Medicine Prize was to be given by the Karolinska Institute; Literature by the Swedish Academy (not the Science Academy) and the Peace Prize by the Norwegian Parliament (then connected to Sweden). The Economics Prize was established by the Swedish Central Bank much later—in 1968.

An International Prize

Nobel specified that the prize should not favor Swedes, and (in an 1893 version of the will) that it should perhaps be rescinded if, in 30 years, the contributions of scientists and world leaders had not led to lasting world peace.

Obviously, that part of his will has been bypassed...

WHO COULD WRITE SUCH A THING?

"Alfred Nobel: His miserable half-life should have been terminated at birth by a humane doctor as he drew his first, howling breath."

—Alfred Nobel, letter to his nephew, who had requested biographical information

Svante Arrhenius

The Nobel Prize money was enormous in its day. Just the annual interest from Nobel's bequest was greater than the yearly budget for Uppsala University, Sweden's leading institution.

The money from a single prize was well over 30 times the annual salary of a typical professor.

Inventing Itself

In the end, the great inventor's prize had to invent itself. There wasn't even a foundation capable of managing the money when Nobel died in 1896. It took a few years to sort it all out.

So, Why No Astronomy Prize?

We can only assume there's no mathematics prize because Nobel, after all, had a practical bent (outside of his fondness for literature). As for astronomy, that had to do more with members of the Swedish Academy of Sciences, such as the great chemist Svante Arrhenius, than with Nobel. Arrhenius, and other academy members, felt that opening up the prize to geophysics and astrophysics might lead to a flood of contenders—and, possibly, detract from the status of atomic physics, which was big in Sweden!

Making Up For Lost Time

George Hale was nominated numerous times, but never won. WWI soon intervened, after which quantum theory sucked up most of the physics prizes. Edwin Hubble was considered—but again, no prize. Lately, there have been prizes for astrophysics: Hulse and Taylor (pulsars and gravitation); Penzias and Wilson (CMB); Schmidt, Pearlmutter and Reiss (accelerating universe). There's absolutely no rule against this. The committees finally relented!

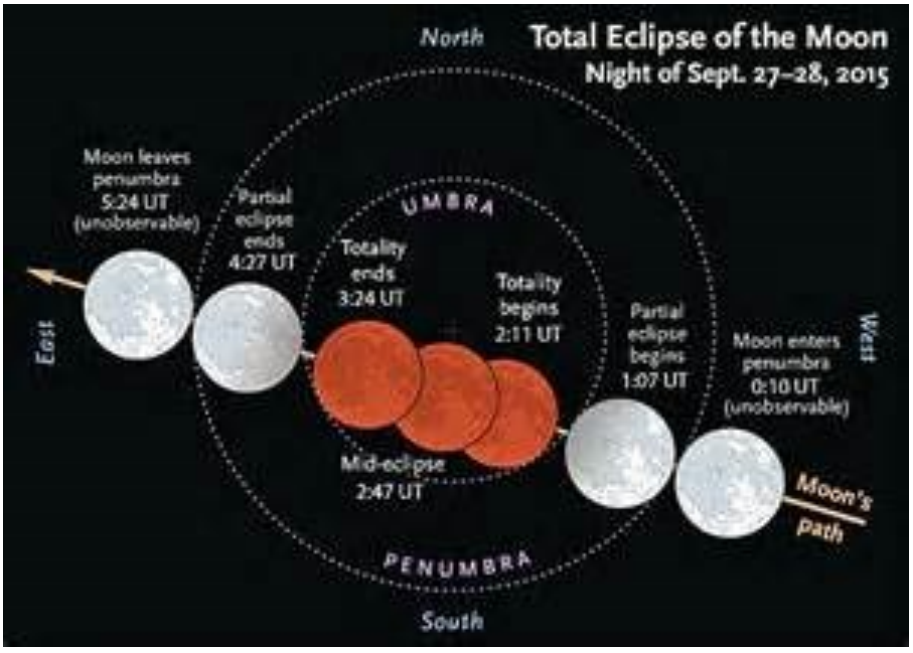
Even Alfred Nobel would likely have been impressed with some of those cosmic explosions.

In the September Skies:

From Griffith Observatory Sky Report (by Tony Cook):

On the morning of September 9th, the International Space Station will make a spectacular dawn appearance, directly over Los Angeles. The ISS will nearly equal Venus in brightness as it crosses the sky from southwest to northeast. The orbiting space laboratory first emerges from Earth's shadow 35 degrees high in the southwest at 5:18 a.m., and sets in the northeast nearly six minutes later. As seen from Los Angeles, the ISS will be directly overhead, and 252 miles away, at 5:20 a.m.

See the Observatory website Sky Report!



For more lunar eclipse information and updates go to:

Griffith Observatory—Sky Report

Sky and Telescope Magazine

NASA/Goddard:

http://eclipse.gsfc.nasa.gov/lunar.html

Pacific Daylight Time is 7 hours behind Universal Time, so, for example, "2:47 UT" on the 28th is 7:47 the previous evening, for us.

September 27 Lunar Eclipse!

The September Harvest Moon (that's the full moon nearest the equinox) will give us an early evening total lunar eclipse, centered (that is, maximum eclipse) at 7:47 p.m. The moon, rising around sunset, is just 19 degrees high when totality ends at 8:23 p.m.

Mythology Lives! Film at 11:00!

The news media loves the phrase "super moon", to indicate that the moon is relatively close to perigee. They also can't get enough of "blood moon". How about "lunar eclipse"?