Monthly Notices of the Everglades Astronomical Society

Naples, FL
June 2016

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President's Message

One would think that there wouldn't be much to write about now that the season is nearing an end. One would be wrong. My problem is always keeping it short.

I hardly even know how to properly express my delight with the work that was done for and on the Mercury transit by our club. The efforts and results of Bart Thomas in conjunction (no pun intended) with the Collier County School Board at Naples High School were outstanding. The day went as smooth as a McDonald's milk shake. The initial organization from setting up the telescopes, transporting our club's equipment from the parking lot to the green space, coffee and bagels, scheduling the students, to final tear down deserves a round of applause. In addition to the actual event, several of our members were able to capture it on "film" and were kind enough to share it with us. Thank you to everyone.

Thanks also go out to Dennis Albright for his presentation on Inflation. Dennis' talks are always filled with lots of information and presented in a charming way. I will not be at the June meeting. Charlie will be standing in for me. Charlie will be showing a DVD. I'm not sure what the topic is, but these programs always contain interesting information. We do not officially meet in July and August, but a group of our members gather at some restaurant just to have a chat. The "where and when" will follow.

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Dates for the "Fak"

Usually the best times to go out to the Fakahatchee Strand viewing site are moonless nights. Below is a list of upcoming Saturday nights that you will often find fellow club members out there enjoying the skies with you (weather permitting).

Date	Moonrise	Moonset
June 25	11:24 p.m.	10:29 p.m.
July 2	3:58 a.m.	5:41 p.m.

Sky Events

June 4 - New Moon
June 12 - First Quarter
June 20 - Full Moon
June 20 - Summer Solstice
June 27 - Last Quarter
July 8 - Jupiter Transit (Callisto)

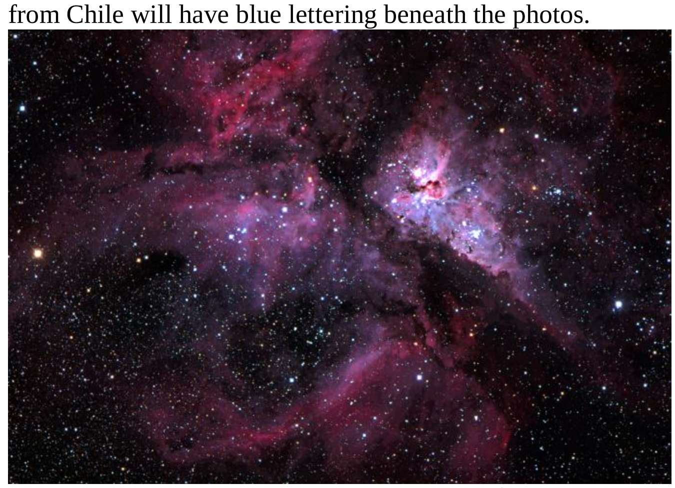
Next Meeting

June 14, 2016: Time 7:00 – 9:00 pm
Norris Center, Cambier Park

TED WOLFE'S FIRST PHOTO FROM CHILE

EAS club member, Ted Wolfe, shared his first photo from Chile with us on May 20th and as you can see, it's absolutely amazing! Thanks for sharing, Ted, and good luck with future pictures. We can't wait to see more.

You can see all of Ted's fabulous pictures at www.tedwolfe.com. Click on "Gallery." All new photos from Chile will have blue lettering beneath the photos.



The Eta Carina Nebula (NGC 3372) taken by Ted Wolfe. Takahashi CCA-250 Astrograph w/ST11000 camera; Astrodon filters; ASA gearless DDM-60 mount; f/5 unguided LRGB (30 @ 8 mins & 8 @ 5 mins. 2x2 RGB).

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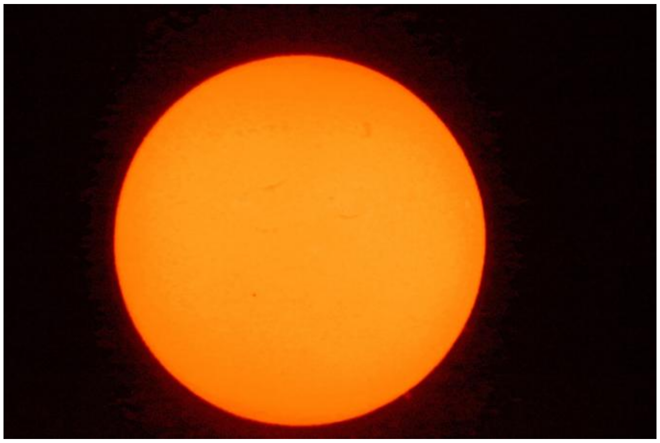
Mercury Transit Across the Sun
May 9, 2016

Volunteers at the Mercury Transit event on 5.9.16 at Naples High School. Club Members left to right, Charlie Paul, Jackie Richards, Rick Piper, Bart Thomas (Naples High School science teacher) and Denise Sabatini. All others are student volunteers.

Mercury Transit by Chuck Pavlick.

Bob Frances @ Naples High School during Mercury Transit.

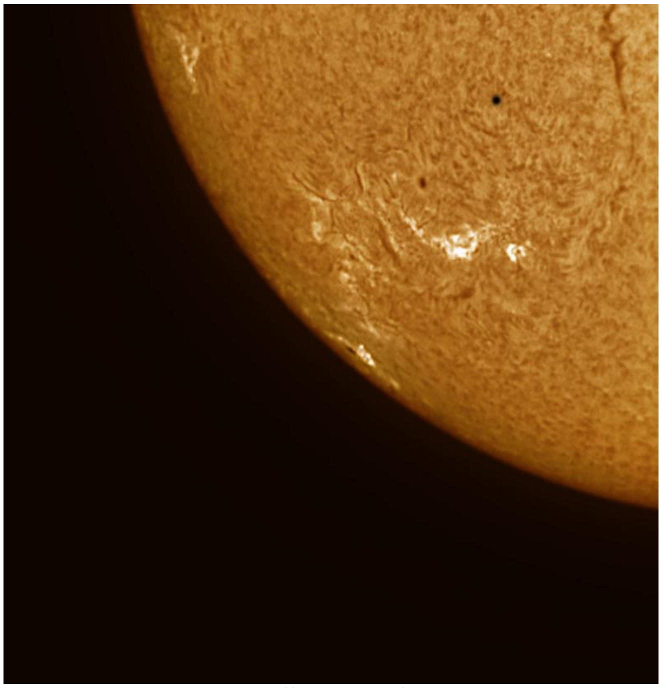


Mercury Transit by Armando Merlo.

Mercury Transit at Naples High School on 5.9.16. Club members, left to right, Bob Frances, Rick Piper and Ted Wolfe.

Rick Piper @ Naples High School during Mercury Transit.

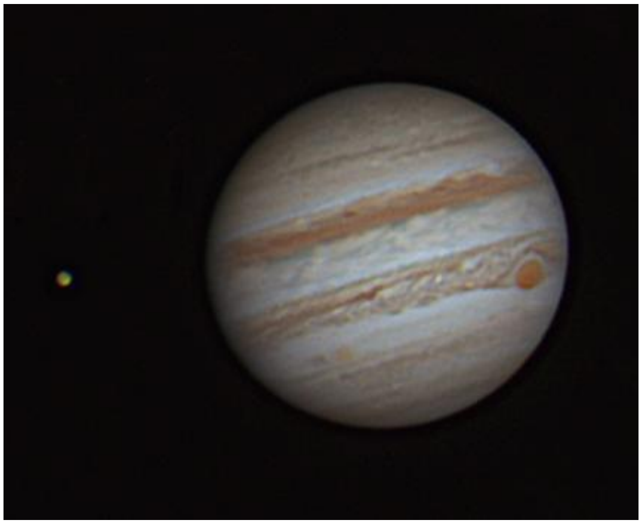
Jackie Richards @ Naples High School during Mercury Transit.



Mercury Transit by Brian McGaffney, Bancroft, Canada.

Fak and Other Photos

Whirlpool Galaxy (M51) taken by Rick Piper and Jackie Richards at the Fak on 5/7/16.



Jupiter and Ganymede by Chuck Pavlick 5/21/16.

Mars by Chuck Pavlick 5/15/16.

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President's Message (Continued from Page 1)

In the last newsletter, I started prompting people to think about next year's programs. We have started that process. If you have topics that you would like to learn about, or give a talk about, it is imperative that you send them along to me. My goal is to have the program schedule ready for the August newsletter so you can put the dates on your calendar.

The quest for the 2017 Solar Eclipse viewing site has begun. I have called several hotels. So far, either they are already booked or they are not taking reservations for a few months. Reservationists were very vague about this. One reservationist stated that the town of Hopkinsville, Kentucky, has a population of 30,000 people. They are expecting that number to exceed 100,000 for the eclipse. I'll keep you updated on any information I might get during my search.

I'd like to wish everyone a happy, healthy, and cool summer. I'll see you in September.

Clear Skies,
Denise Sabatini

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Published Articles by EAS Members

Ted Wolfe's article in the Naples News/Collier Citizen on May 24, 2016, Looking Up: Almost in the zone: Mars is the closest its been in more than 10 years .

http://www.naplesnews.com/community/collier-citizen/looking-up-almost-in-the-zone-mars-is-the-closest-it-has-been-in-more-than-10-years-3383d66a-3149-3c-380654991.html

TO VIEW THE ABOVE ARTICLE, PRESS "CTRL" AND LEFT CLICK BUTTON.

The below link provides previous articles in the Collier Citizen by Ted Wolfe that appeared over past years.
http://search.naplesnews.com/jmg.aspx?k=looking+up+ted+wolfe

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The Mechanism of Inflation – My Theory By Dennis C. Albright

What is Inflation?

It has been found that Universe is both isotropic and homogeneous over large regions of space. In particular, the Cosmic Microwave Background (CMB) radiation is almost perfectly uniform at a temperature of 2.725 ^{o}K. The cosmic microwave background radiation is everywhere equal to the average CMB temperature to within .00002 ^{o}K. The cosmic microwave background radiation is the most uniform quantity that scientists have ever measured.

Over relatively large distances, roughly, 100 million light years or so, the distribution of galaxies is also homogeneous and isotropic.

For this isotropy and homogeneity to occur, the Universe had to be in thermodynamic equilibrium and then expand extremely rapidly maintaining its thermal equilibrium. In fact, to do this the Universe initially had to expand at a speed much faster than the speed of light, c.

This expansion of the Universe was the expansion of the fabric of space-time not the motion of energy or particles within the fabric of space-time. For that reason this expansion at a speed faster than the speed of light is possible according to Einstein's Theory of General Relativity. This rapid expansion of the fabric of space-time at the birth of the Universe is called inflation.

Unfortunately, the books I've read have been very ambiguous as to the exact cause of inflation. Usually they say that the cause of inflation is a phase change in the Universe within the primordial singularity. In this article, I'll try to explain to you my theory of the cause of inflation.

It is important to note that I am not a real cosmologist, an astrophysicist or an elementary particle physicist. Furthermore, I have simplified my explanation to facilitate comprehension by the membership of the EAS. Therefore, my theory of the cause of inflation may be a wild guess or only a very crude approximation at best.

But first I have to explain some basic physics including the basic mathematics of radioactive decay and the two basic types of elementary particles.

Radioactive Decay

If radioactive nucleus, A, decays into the stable nucleus, B, and the particle, C, and giving off energy, E, in the process:

$$A \rightarrow B + C + E$$

The C particle can be an alpha particle, which is a Helium-4 nucleus, He^4, an electron, a neutrino, or antineutrino. In this decay energy, E, is released because the mass of the initial nucleus, m_A, is greater than the combined mass of the stable nucleus, B, m_B, and the particle, C. m_C:

$$m_A > m_B + m_C$$

The energy released in this reaction can be calculated from this mass difference using Einstein's formula:

$$E = (m_A - m_B - m_C)c^2$$

This energy, E, is released as the kinetic energy of the decay products and/or the energy of the emitted gamma ray, γ.

Then the number of stable B nuclei, $N_B(t)$, is a function of time, t, and is determined by the equation:

$$N_B(t) = N_{A0}(1 - e^{-zt})$$

Where the quantity, N_{A0}, is the initial number of unstable A nuclei and z is the decay constant for the reaction. Initially there are no B nuclei:

$$N_A(0) \quad = N_{A0}$$

$$N_B(0) = 0$$

This is because:

$e^{-0} = 1$

Then as the time increases, the number of B nuclei increases exponentially until all the A nuclei have decayed. Virtually all of the A nuclei have decayed when:

$\lambda t >> 1$

This is because then:

$e^{-\lambda t} = 0$

Then:

$N_B(t) = N_{A0}$

$N_A(t) = 0$

The Two Basic Types of Elementary Particles

There are two basic types of elementary particles: bosons and fermions. Each of these types of elementary particles has very distinct properties.

Spin is the amount of angular momentum that an elementary particle possesses. It is one of the principal properties that an elementary particle possesses. Some of the other properties of elementary particles include: mass, charge, magnetic moment and parity. The sign of the spin of the elementary particle can be either positive or negative depending on the orientation of the particle relative to a given fixed direction like a magnetic field.

Bosons are particles with integer spins: 0, 1, 2, 3, . . . Photons, γ, the particles of light, have a spin of 1 and are bosons. Pions which are considered to be the particles that create the strong nuclear forces between neutrons and protons, have a spin of 0 and are also bosons.

Fermions are elementary particles with half integer spin: 1/2, 3/2, 5/2 etc. Protons, p, neutrons, n, and electrons, e, the basic constituents are Fermions as are quarks, q, and neutrinos, ν. They have a spin of 1/2 and are therefore also Fermions.

Fermions obey the Pauli Exclusion Principle which states that two particles cannot have the same energy and quantum numbers. This essentially means that only 2 fermions of the same type can be in the same place at the same time and that's only if they have opposite spins. For example, 2 electrons can be in the same orbit around an atom because one has a spin of +1/2, the other has a spin of -1/2 because its spin axis is pointing in the opposite direction as the first electron.

Furthermore, Fermions obey a conservation rule that states that to create a Fermion from energy an anti-Fermion must be created so that the total number of the types of Fermion in the Universe remains the same as does the total spin.

Boson, however, don't obey the Pauli Exclusion Principle. Therefore, you can put as many bosons in as small a place as possible. Furthermore, Bosons don't obey any conservation rule: that is, you can generate as many bosons as you want if you have enough mass-energy. You don't even have to create any anti-bosons.

This is particularly true for the particles of light, photons, because they are considered to be their own anti-particles. An example of this when you heat a piece of metal and it glows, it does so because the heat is creating photons which are bosons.

The Mechanism

Somehow, the Universe came into being as a single particle, U, in the initial singularity. The initial particle of the Universe had to be a boson, because it could be created out of nothing and occupied no volume. However, because of either the initial temperature or mass of the particle or the values of physical constants in our universe, this particle was unstable and decayed rapidly into a large number of bosons, b:

U -> b + b + b + b +...

This decay also released energy in the form of the kinetic energy of the bosons which causes the temperature of the Universe to increase.

Then each of the bosons, b, decayed into a Fermions, f, and an anti-Fermions, f*:

b -> f + f*

This decay also released energy into the new Universe in the form of the kinetic energy of the Fermions and anti-Fermions causing the temperature of the new Universe to rise even further. The bosons had to decay into a particle-antiparticle pair in order to fulfill the two basic conservation laws – conservation of Fermions and conservation of angular momentum or spin.

However, because of the Pauli Exclusion Principle the Fermions and the anti-Fermions each occupied finite volumes causing the fabric of the space-time of our Universe to expand to accommodate the finite volume required for each pair of Fermions or anti-Fermions:

$$V_U(t) = V_{f0}N_{b0}(1 - e^{-zt})$$

Where $V_U(t)$ is the volume of the universe as a function of the time after the bosons started to decay, t, and z is the decay constant for the decay of the primordial bosons into the first generation of fermions and anti-fermions. The quantity, V_{f0}, is the volume occupied by each pair of fermions. The quantity, N_{b0}, is simply the number initial bosons, b.

Since the Universe is spherically symmetric, the radius of the Universe, $R_U(t)$, is simply:

$$R_U(t) = [3V_{f0}N_{b0}(1 - e^{-zt})/4\pi]^{1/3}$$

This is the type of exponential increase in radius that is required by inflation theory. In this equation it is assumed that the initial radius of the Universe, $R_U(0)$, is

$$R_U(0) = 0$$

At the end of inflation the radius of the Universe, R_{Uf}, is

$$\lambda t >> 1$$

$$e^{-zt} = 0$$

$$R_{Uf} = [3V_{f0}N_{b0}/4\pi]^{1/3}$$

Limiting Size of Space-Time

There is a lower limiting length of space-time, called the Planck length, L_P, which is calculated in the following manner:

$$L_P = (hG/2\pi c^3)^{1/2}$$

The 3 constants in this equation are Planck's constant, h, the gravitational constant, G, and the speed of light, c. Presently, the Planck length has a value of:

$$L_P = 1.6162 \times 10^{-35} \text{ m}$$

This is much smaller than the radius of proton, r_p, which is:

$$r_p = 0.844 \times 10^{-15} \text{ m}$$

There may also be a limiting volume, V_P, which is a cube with the Plank length as its edge:

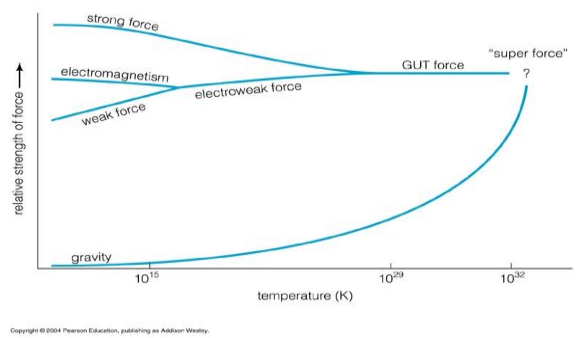
$$V_P = L_P^3$$

However, inside the singularity at the origin of the Universe, the temperature was approximately 10^{32} ^oK. This huge temperature is due to the decay of the initial particle, U, into the bosons, b, and the decay of the bosons, b, into the Fermions, f, and anti-Fermions, f*.

There are four basic forces in our Universe: the electromagnetic force, the weak nuclear force that causes some forms of radioactive decay, the strong nuclear force that holds nuclei together and gravity.

According to the Grand Unified Theory, GUTs, of elementary particles at this temperature all 4 forces have the same strength. This is shown in Figure 1.

Figure 1. Convergence of the Strength of the 4 Basic Forces



At this elevated temperature, the Gravitational constant during the Big Bang, G_{BB}, would be roughly equal to the coupling constant for the strong or nuclear force, g_N. The accepted value of the coupling constant for the nuclear force, g_N, is much larger than the gravitational constant, G, at the present temperature of the Universe:

$$g_N >> G$$

Therefore at the origin of the Universe the Planck length, L_{PBB}, will also be much larger than in the present Universe:

$$L_{PBB} >> L_P$$

During the Big Bang, the volume occupied by each pair of fermions, V_{f0}, is simply:

$$V_{f0} = L_{PBB}^3$$

At the end of inflation the radius of the Universe is

$$R_{Uf} = [3N_{b0}/4\pi]^{1/3}L_{PBB}$$

It is almost impossible to determine the initial number of bosons, N_{b0}, during the big bang since we don't understand all of the interactions that led to the formation of the protons, neutrons, electrons and dark matter particles in our present Universe.

Multiverse Theory

During the big bang, the Planck Length, L_{PBB}, was much larger than the radius of a proton:

$$L_{PBB} >> r_p$$

This is very significant because the range of the nuclear force is approximately the radius of a proton.

This means that after inflation occurs, only gravitational forces are long range enough to cause the Universe to collapse back into a singularity. During inflation the Universe may have cooled very substantially depending on the energy of the boson decay. Due to this cooling, the gravitational constant has decreased and gravity, alone, is not enough to cause the Universe to collapse back into the initial singularity.

These results also have implications for multiple universe theories, or multiverse theories. In multiverse theories, multiple singularities have created multiple universes.

However, if the singularity has an initial temperature that is too low, the singularity's gravitational constant, G, never approaches the nuclear coupling constant, g_N, in value. In this case the singularity's Planck length is small enough so that the nuclear force can help gravity collapse that universe back into the singularity.

If, however, the singularity has an initial temperature that is too high, then the gravitational constant may have a value that greatly exceeds that of the nuclear coupling constant. With this high value for the gravitational constant, gravity, alone, could cause the collapse of this universe back into the singularity.

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NOAA's Joint Polar Satellite System (JPSS) to revolutionize Earth-watching
By Ethan Siegel

If you want to collect data with a variety of instruments over an entire planet as quickly as possible, there are two trade-offs you have to consider: how far away you are from the world in question, and what orientation and direction you choose to orbit it. For a single satellite, the best of all worlds comes from a low-Earth polar orbit, which does all of the following:

- orbits the Earth very quickly: once every 101 minutes,
- is close enough at 824 km high to take incredibly high-resolution imagery,
- has five separate instruments each probing various weather and climate phenomena,
- and is capable of obtaining full-planet coverage every 12 hours.

The type of data this new satellite – the Joint Polar Satellite System-1 (JPSS-1) -- will take will be essential to extreme weather prediction and in early warning systems, which could have severely mitigated the impact of natural disasters like Hurricane Katrina. Each of the five instruments on board are fundamentally different and complementary to one another. They are:

1. The Cross-track Infrared Sounder (CrIS), which will measure the 3D structure of the atmosphere, water vapor and temperature in over 1,000 infrared spectral channels. This instrument is vital for weather forecasting up to seven days in advance of major weather events.

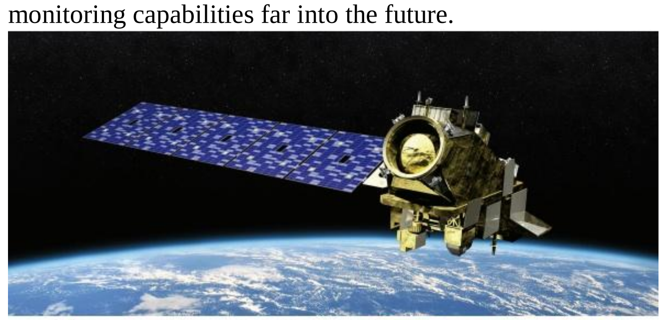
2. The Advanced Technology Microwave Sounder (ATMS), which assists CrIS by adding 22 microwave channels to improve temperature and moisture readings down to 1 Kelvin accuracy for tropospheric layers.

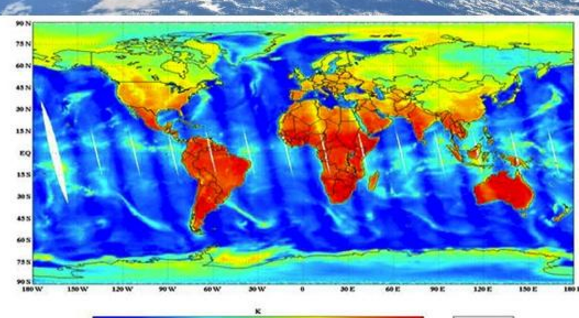
3. The Visible Infrared Imaging Radiometer Suite (VIIRS) instrument, which takes visible and infrared pictures at a resolution of just 400 meters (1312 feet), enables us to track not just weather patterns but fires, sea temperatures, nighttime light pollution as well as ocean-color observations.

4. The Ozone Mapping and Profiler Suite (OMPS), which measures how the ozone concentration varies with altitude and in time over every location on Earth's surface. This instrument is a vital tool for understanding how effectively ultraviolet light penetrates the atmosphere.

5. Finally, the Clouds and the Earth's Radiant System (CERES) will help understand the effect of clouds on Earth's energy balance, presently one of the largest sources of uncertainty in climate modeling.

The JPSS-1 satellite is a sophisticated weather monitoring tool, and paves the way for its' sister satellites JPSS-2, 3 and 4. It promises to not only provide early and detailed warnings for disasters like hurricanes, volcanoes and storms, but for longer-term effects like droughts and climate changes. Emergency responders, airline pilots, cargo ships, farmers and coastal residents all rely on NOAA and the National Weather Service for informative short-and-long-term data. The JPSS constellation of satellites will extend and enhance our monitoring capabilities far into the future.





Images credit: an artist's concept of the JPSS-2 Satellite for NOAA and NASA by Orbital ATK (top); complete temperature map of the world from NOAA's National Weather Service (bottom).

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Items For Sale or Trade or Wanted:
http://www.naples.net/clubs/eas/equipment_sales.html

Useful links (software, telescope making, telescope and equipment suppliers, astronomical data sources, iPhone and iPad Apps and more):
http://www.naples.net/clubs/eas/links.html

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EAS 2016 DUES

For the bargain price of only $20.00 per family, all this can be yours this year:

- Meet with your fellow astronomy enthusiasts at least 10 times a year;
- Learn about astronomy and telescopes. Check out our club scope;
- Many opportunities to view planets, nebulae and other celestial objects (even if you don't have your own telescope); and
- Enjoy the many astronomy programs at our regular monthly meetings.

Don't miss out! Fill out this form (please print clearly) and send it with your $20 check to the

Everglades Astronomical Society, P. O. Box 1868, Marco Island, Florida, 34146.

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