Natural Radio

News, Comments and Letters About Natural Radio

December 2013

Cycle 24 – After a rather calm year, it looks like Solar Cycle 24 may be a double-peaked cycle. We are close to the peak of Cycle 24. The sun usually flips polarity at the peak of the cycle, and at this point the magnetic north pole has flipped but the south pole hasn't, so both poles have the same magnetic polarity. The south pole should catch up soon.

This might seem weird, but while the bar magnet model with two poles represents the earth's magnetic fields quite well; it doesn't work for the sun. The sun has a large number of magnetic fields scattered all over the surface.

The pole reversal is very gradual as sunspots with their tangled magnetic fields emerge and fan out towards the poles. As this happens, the flux that they carry with them replaces the existing polar fields with ones of opposite polarity.

There has been a lot of solar activity this past month, with many strong X and M flares, but most of the CME's (coronal mass ejections) were pointed away from the earth, so there were no major geomagnetic storms. However, historically, the biggest solar storms tend to occur on the downward edge of the solar cycle, so we could be in for a lot of interesting activity in the next year.

Comet ISON – It's the week of Thanksgiving and by the time you read this, Comet ISON will have had its encounter with the sun and we will know if it survived or not. There could be some great comet viewing in the next couple of weeks depending on what happened during the Thanksgiving encounter, so check the net to see what happened and get outside and look at the sky if the viewing is expected to be good.

There is some speculation going on as to what would happen if the comet got hit by a CME as it swung around the sun. In 2007, a solar storm hit Comet Encke. The NASA STEREO spacecraft observed a CME (coronal mass ejection) striking the comet head on and ripping off its tail. This was amazing to earthly astronomers.

On Nov. 28th, Comet ISON passed through the sun's atmosphere, flying little more than a million kilometers above the sun's surface. It was ~30 times closer to the sun than Encke was in 2007, thus more likely to encounter a solar storm. This is now history, but it might be something you'll want to search for on the web. I'll be posting updates on the Natural Radio Lab website if anything significant happens at www.naturalradiolab.com.

CMEs are, of course, clouds of plasma that carry a magnetic field, and are often the result of a sunspot being ripped apart. Although the CMEs contain many million tons of material, they are not very dense, since they are so large. The wispy plasma doesn't have enough energy to shatter the comet's core. However,

the fragile tail is another matter. The tails of comets are as thin as the CME, so the results of a collision are unpredictable.

When Comet Encke encountered a CME in 2007, the relative collision was slow, barely creating a pressure pulse by compressing the solar wind ahead of it; but the compression was strong enough to relieve Encke of its tail. There could be some interesting observations in December. The encounter with the sun is being observed by the STEREO satellites.

Firestation – Information on NASA's Firestation project has been scarce and I have yet to find anything about the data coming down from the ISS. But, I did find a couple of things about the intent of the mission and more specific information about the instrumentation package.

Doug Rowland, is the principal investigator for FireStation at NASA's Goddard Space Flight Center in Greenbelt, Md. He believes that without the specific instrument and the platform of the space station, studying the gamma ray flashes could be "chicken or the egg" type scenario.

"We are measuring lightning flashes—which has been done before—and we are measuring gamma ray flashes—which has been done before—but we are doing it on the same platform, so that we can see for the same event, the lighting and the gamma rays it produces," he said. "You can imagine a case where if you don't know exactly where the events and the signals were traveling at different speeds, you might reverse the cause and effect. So having it in the same platform is new and very helpful."

Personally, I'm hoping this will lead to a better understanding of whether only specific types of lightning trigger whistlers, and whether sprites, jets and these gamma ray flashes produce telltale types of whistlers or other VLF emissions.

The exact workings of the onboard VLF receivers were a bit sketchy in my last article. Here is a more detailed description of the instrumentation, taken from the project fact sheet.

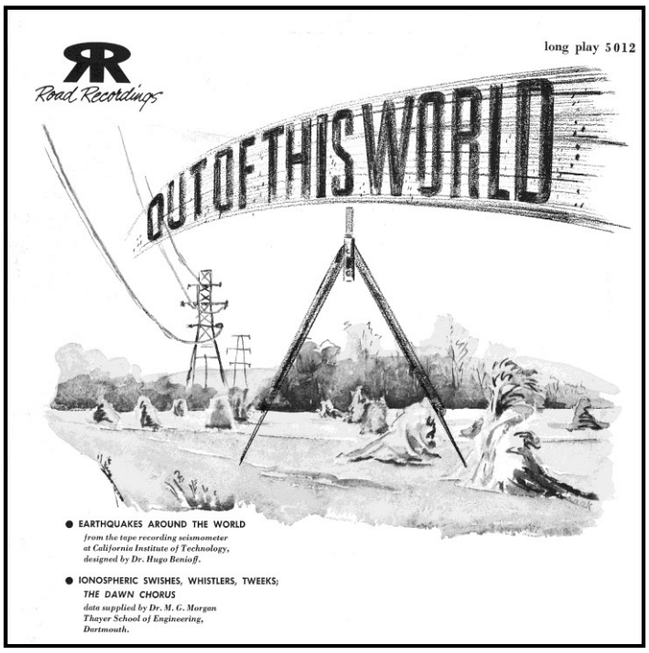
> Space Test Program-Houston 4-FireStation (STP-H4-FireStation) consists of two components – a gamma ray / photometer system, that measures the optical flashes from lightning, the gamma ray emissions, and the secondary energetic electrons, and a radio receiver system that measures the electric and magnetic field signatures of lightning. The gamma ray / electron detector is a single scintillator "phoswich" (a phosphor sandwich detector) configuration, using GYSO:Ce (scintillator crystal) and PVT (plastic) scintillator, allowing the discrimination between electrons and gamma rays via the decay time of the signal, and using pulse height analysis to determine the energy of the incoming radiation. The optical system consists of nine fast photodiodes (sampled at 100 kHz) with different look directions in order to identify lightning, trigger the wave receiver burst memory, and provide a rough localization of lightning flashes within several viewing sectors.
>
> The radio receiver consists of a dipole electric field antenna in a "rabbit-ears" configuration, 24 in long, and a "search coil" magnetic loop antenna wrapped around a ferrite core. The electric dipole covers the frequency range 100 Hz to 30 MHz, and the magnetic loop antenna runs from 20 Hz to 10 kHz.
>
> The gamma ray detector can timetag individual events with sub-microsecond accuracy and can handle average count rates of about 100K counts per second, with 2 μs dead time.

STP-H4-FireStation takes continuous measurements of the electron and gamma ray spectra, as well as the count rate every millisecond and the light levels in the photodiodes at 1 kHz rate. When the count rate rises above a threshold, the high rate photometer digitization data is stored and sent to the ground, as well as the radio receiver data, to provide a tens of millisecond-long "snapshot" of the optical and radio signatures that produced a given gamma ray or electron enhancement.

You can find more information about Firestation on the project fact sheet at http://www.nasa.gov/mission_pages/station/research/news/FireStation/#.UpK9lycnOF9

Natural Radio Ephemera – Since I've active in Natural Radio for going on 20 years, I thought it might be nice to have a few display items that related to the hobby.

I already had an original copy of Robert Helliwell's 1965 book, *Whistlers and Related Ionospheric Phenomena*. I got it for its informational value, but as a collectible, it has a very significant place in Natural Radio and is still one of the main references to Whistlers and other Natural Radio signals.



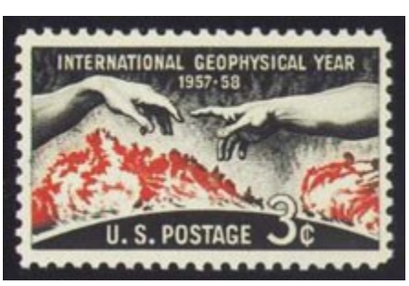
As I wrote about a couple of years ago, I acquired a copy of an Emory Cook LP record, *Out of This World*. This record had early natural Radio recordings made by Dr. Millett Morgan of Dartmouth University in the 1950s.

This and its companion recording, *Ionospheres*, are probably the earliest available recordings of Natural Radio sounds.

Wanting to expand my collection a bit, I spent some time scouring eBay and found a couple of items.

The International Geo-Physical Year in 1958 was the beginning of modern research into the ionosphere and space weather.

Robert Helliwell, Dr. Millett Morgan and James Van Allen were some of the key players in this project. Here is a First Day Cover that commemorated that event.



The US stamp issued for the IGY was a 3cent stamp (remember those days?) with the surface of the sun and solar prominences at the bottom. The hands from

Michelangelo's painting, *The Creation of Adam*, which have become an icon for humanity, were across the top.

Much of the early VLF research, before the days of advanced scientific satellites was carried out through VLF transmitting and monitoring stations based at the South Pole.

Here is a 1967 QSL card from the Byrd VLF substation in Antarctica.

It was the site of the University of Washington's 21 mile dipole antenna. Electrical engineering professors H. Myron Swarm and Donald K. Reynolds had initiated a program of Antarctic research in the early 1960s, with the construction and testing of the 21-mile dipole antenna near Byrd Station, which began UW's long and productive research in Antarctica. Since the contact was on 20 meters, I'm sure that the dipole wasn't used for the QSL.

Finally, I found a press photo of Dr. James Van Allen from the University of Iowa. Van Allen was instrumental in the design of Explorer I, the first satellite launched by the United States in 1958, atop a Juno I rocket.

The data sent back by this satellite indicated that the earth was surrounded by an intense belt of radiation, trapped within its magnetic field.

For this discovery, his colleagues accorded him the honor of having these belts named after him.

This is a 1967 photo of Van Allen in his office. Partially hidden by his head, there is a shortwave receiver and speaker sitting on the shelf behind him. As near as I can tell, it appears to be a Hallicrafters SX-111.

I have a couple more first day covers from eBay on the way and I am hoping to acquire a few more items for my collection to celebrate the early days of Natural Radio and our knowledge of the Ionosphere and space weather.

Happy Holidays to everyone. May you enjoy the warmth of family and friends in the coming month and have a healthy and happy New Year.