Natural Radio

News, Comments and Letters About Natural Radio

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Lights in the Sky, Audible Meteors, Skeptics and Science – Lights in the sky have always been a fascination to mankind. Lightning, meteors and auroral displays have been watched and documented since before recorded history and are intertwined with myths, legends and stories in many cultures. The scientific bases for these phenomena are well enough understood to go beyond the mythical and legendary explanations, but they are still surrounded with enough mystery to fascinate and amaze us.

I have been a sky watcher ever since I can remember. My uncle Steve, whose back yard adjoined ours, had an 8-inch reflector telescope permanently installed on a concrete pad. On summer nights, he'd screw on the mirror assembly and lift up the 50 pound lead counterweight and install it on the arm attached to the telescope tube. We would look at moon craters or the rings of Saturn, and I soon learned how to adjust the knobs that moved the telescope to keep the object in view. Later, he taught me about the motion of the planets, the constellations and what a "light-year" was.

My first encounter with the Northern Lights when I was about 10. My mother's youngest sister, only 8 years my senior and more like a sister than an aunt, called and told me that the Northern Lights were out. I asked where to look and was told something to the effect of "To the north, you twit.", and spent the next several hours gazing out of our front window and watching what looked like green and red searchlights sweeping across the northern sky.

And I was always interested in radio – at least since my dad built me a crystal set at an early age. The interest continued through ham radio, commercial radio and on to college. Sky watching and radio came together in Natural Radio, because most things that light up the sky tend to generate radio waves as well, and mostly in the VLF range. And a big draw of Natural Radio is being on the cutting edge where as amateur observers, there is always the possibility of discovering, or at least being part of the discovery of some new phenomenon.

Often, the myths, stories and anecdotal reports are a good place to begin when you want to do some research. For example, beyond lightning, meteors and the aurora, there are other luminous phenomena that are just beginning to have scientific confirmation.

Although there had been anecdotal reports of a strange luminous phenomenon above thunderstorms for over 100 years; and even when reported by a Nobel Laureate (C.T.R. Wilson), the scientific community had little belief that any of these observations had any truth.

It took an accidental photograph of a Red Sprite in 1989 by a retired physicist, Dr. John R. Winckler, helping a friend try out a new low-light video camera, to confirm the existence of Red Sprites. So here's a major luminous phenomenon that has only been observed for a little over 25 years.

Of course once the scientists knew what they were looking for, they were able to take thousands of photographs of Red Sprites, and in the process, discover Blue Jets and Elves. More recently discovered are Sprite Halos, Trolls, Gigantic Jets. and some non-luminous emissions called TIPPS (Trans-Ionospheric Pulse Pairs) and Gamma Ray Bursts. Visit the site at http://www.albany.edu/faculty/rgk/atm101/sprite.htm for more information.

The conclusion here is that time and time again, it often pays off to investigate persistent anecdotal reports from reliable sources. Unfortunately, some observations have been so corrupted by pseudo-science, superstition and charlatans raking in large amounts of money on the "talk show – book deal" complex, that it's almost impossible to find anything factual. Now of course, a healthy skepticism is part of science, but rather than totally write off the observations, good science demands that we dig the "signal" (credible observations) out of the "noise" of all the misinformation.

Studies of certain luminous phenomenon like earthlights have been handicapped by skeptics who try to discredit the whole observed phenomenon rather than just the false observations and false conclusions. Scientists stay away from fields like this because of fears that any association with it could kill their career. This is politics running science.

When one is aware of all the different currents flowing in the ionosphere, the amount of energy released during a geomagnetic storm and the havoc it can wreak on the power grid, and the fair weather currents that balance out the circuit with lightning discharges – it's not unreasonable to hypothesize that there might be a few glowing lights and Natural Radio emissions out there that we haven't accounted for yet.

The Hessdalen Valley in central Norway has a long history of lights moving through the sky and along the earth at night. From the end of 1981 through 1984, there were reports about strange, unexplained lights that appeared at many locations throughout the Valley. Observations of lights were in the hundreds. At the peak of activity there were about 20 reports a week, although the activity has now dropped to about 20 reports per year. Project Hessdalen was formed to study the lights in 1983 under the auspices of *Østfold University College*. Instruments were put in place over the years, and teams of scientists go to the valley during the summer months to study this phenomenon and place recording instruments including VLF receivers and cameras in the valley. Read about the Hessdallen Project at http://www.hessdalen.org/.

A year or so ago, one of the researchers wanted to discuss the Hessdalen Project on the VLF_Group discussion board, but was afraid that the skeptics would attack him and any reasonable discussion would degenerate into a flame war. I haven't seen any postings from him in a long time. How sad that the fear of a few loudmouths would prohibit a valid scientific discussion.

This past month I read Renato Romero's report titled *Luminous Phenomenon in the Hessdalen Valley and VLF - An analysis of several signals gathered by Renato Romero and Jader Monari.* "This report is an analysis of a number of samples taken from the various audio files gathered during the field investigations carried out in Hessdalen in August 2000 in order to study any correlation between VLF emissions and the well-known light phenomenon." Read it at http://www.vlf.it/hessdalen/hessdalen.htm.

The report is the result of some of the analysis of some of the VLF recordings made in August of 2000. This analysis found no anomalous VLF radio signals. Renato's conclusion was that it would be helpful in the future to have video recordings of the lights to try and coordinate with the VLF recordings.

Trying to coordinate a VLF signal with any type of observation, be it an earthquake, luminous observation or a meteor is going to take considerable research and effort.

Most Natural VLF signals start with a harmonic-rich impulse and develop their characteristic sound by the filtering and dispersion that takes place over long propagation paths.

I would hypothesize that VLF and ELF signals, if they exist, from events like luminous phenomenon, earthquakes and meteors will likely be sferic-like since they are the result of electrical impulse or discharge. Also, they will most likely be received at short range where they haven't had the time to be modified like a whistler or tweek. It's unlikely, that any yet undiscovered VLF emission is going to produce a signal that is so different that it sticks out from the stuff we normally listen to. So, what we'll be looking for is a needle in the haystack of background sferics, hiss and noise.

In my February, 2002, column in *The Lowdown,* I discussed a study done several years ago, documented in a paper authored by Colin Price and Moshe Blum from the Department of Geophysics and Planetary Science at Tel Aviv University. During the 1999 Leonid Meteor shower, they made VLF measurements from the Negev Desert in Israel, which was fortunately well positioned for the peak of that meteor shower. The paper is in the NASA archives at http://leonid.arc.nasa.gov/MS025.pdf.

They detected electromagnetic pulses at the rate of 15,000 per hour, which is at least 50 times the visual rate for meteor observations! They VLF pulses from the meteors were similar to sferics with the following differences: A lightning pulse from distant lightning lasts about 1 ms. and has its peak energy in the 6Khz. range. An electromagnetic pulse from a meteor lasts longer, about 10 ms., has its peak energy in the 1 kHz range, and is about 20 db. quieter than a lightning pulse.

The point here is that to the casual observer, meteors sound just like more background sferics and noise. It takes additional study and coordinating with other observations, often visual, to isolate the desired signal from the other background signals and thus begin to make a meaningful analysis of it.

Here's another story of anecdotal evidence that has finally been given some credibility. In that same February, 2002, article I wrote about Colin Keay's theories of how meteors might possibly produce electrophonic sounds.

In a paper titled "Instrumental Recording of Electrophonic Sounds from Leonid Fireballs" – (Zgrablić et al. *JOURNAL OF GEOPHYSICAL RESEARCH*, Vol. 107, No. A7). http://www.people.fas.harvard.edu/~sgaraj/publications/JGR-ephones.pdf, observations of electrophonic sounds from meteors are discussed.

Researchers from Croatia, Switzerland, the US and Italy, traveled to Mongolia a few years ago and were able to record and document the electrophonic sounds of meteors produced by fireballs during the 1998 Leonid shower. This confirms many years of anecdotal reports about the sounds produced by certain meteors.

The sounds heard and recorded were low frequency "popping" sounds. There was no VLF indication on there receivers, but the receivers had a low frequency cutoff in the 500 Hz range. The theorized that the ELF signal responsible for the electrophonic sound was well below 500 Hz. This conclusion is bolstered by the fact that 10 Hz. ELF emissions were detected recently during the re-entry of an earth-orbiting satellite where electrophonic sounds were heard.

It will be interesting if the same type of study is done on auroras.

So, beyond a healthy skepticism, one needs to keep an open mind to new theories and observations. They new to be tested by proper scientific methods and the results need to be verified by other researchers. But peer pressure and vocal skeptics should never prevent one from pursuing a valid scientific inquiry.

Today's science is team science. Unlike early scientific discoveries made by a scientist working alone in his lab, most new discoveries are made in a group setting or with lots of collaboration. Most of the obvious discoveries have been made, so finding and understanding the more subtle and less obvious parts of science takes more effort and more manpower.

The Internet has made this collaboration possible in a new and revolutionary way, and it is available to almost everyone. It has been said that the Internet will have far more impact on human progress than the invention of movable type. And we're just at the beginning. That's what makes Natural Radio and all the related sciences so interesting and exciting.

Your Much Appreciated Correspondence

• **Mitchell Lee, San Jose, CA** I thought I'd let you know what excellent conditions I encountered a week ago, on a backpack trip. I went with several friends from work for a 2-day hike into the Carson-Iceberg wilderness area, near Sonora Pass. We hiked in 4 miles with a little over 2,000 feet net elevation gain.

On the afternoon of Saturday, September 10th I deployed my 100' wire in some lodgepoles and hemlocks. That evening at about 10pm (9/11/2005 0500 UTC) I heard tweeks of just one pitch, and not an especia1ly high level of activity at that. I woke up around 6am the next morning, and lay there in a slumber awaiting sunrise for about 30 minutes. Suddenly I recalled that my WR-3 whistler receiver was sitting there and I cou1d have been listening for activity. That was "around 1330 UTC on 9/11/2005.

Imagine my surprise when I turned it on and heard two distinct layers of triggered emissions; one layer of barking risers and another layer of chorus. On top of this there were some hissing, one-hop whistlers, which made an initial start, but before descending very far reset to the original starting pitch and made a complete descension like a normal whistler. I thought perhaps that there were simply two paths operating at once, but the initial false start seemed to cut off completely, and there was no evidence of two simultaneous whistlers, offset in frequency.

I listened until about 7am, when I got up for breakfast and a great sunrise. Listening again briefly at 8am I could still hear activity, but weakened in strength by the advancing solar radiations.

I took the WR-3 on another trip in August, and there was zero activity, except for tweeks, of course. I always try to take the WR-3 on any backpacking or skiing trip so I can get in some hum-free listening.

The WR-3 works great with any length of wire. I use a 100' length of vinyl insulated stranded wire, simply strung through the trees slightly over head height, or even across low lying bushes, to effect a plenty-loud antenna. In fact, at times I wish there was more attenuation in the volume control.

For ground you can just hold the unit with your bare hand, but I've found a short clip lead to a metal tent stake, or a 1/16" diameter, 16" long aluminum welding rod pushed to the hilt into the ground works very well. There is only a slight change in tenor when you touch the case. In the winter, ground is problematic, and I carry a second 100' wire to act as a counterpoise. I added a ground lug under one of the cover screws for attaching an alligator clip to the case.

On Saturday morning of Field Day 2004 I laid my WR-3 across our 250' V-beam and was surprised to find all kinds of interesting magnetospheric activity like I'd never heard before. Unfortunately I had no tape recorder, and I only had a minute or two to listen before the antenna was put into use on the ham bands. The WR-3 was happy to amplify the signals at the feedpoint, which was about 150' from the apex of the V-beam, fed through 450-ohm, copperweld type ladder line. I suspect the line capacitance and the resistance of the copperweld helped attenuate radio signals somewhat, but the WR-3 is also fairly robust where RF is concerned.