Natural Radio

News, Comments and Letters About Natural Radio

February 2002

Solar Max - Round Two Scientists at NASA have noted an increase in Solar activity and are saying that we are at the second peak of the current Solar cycle. The previous two cycles were also double peaked. It looks like we're in for some more strong solar activity for the next year, especially since the strongest flares tend to occur on the waning edge of the cycle.

Meteors – Mystery & Opportunity I have always been fascinated by unusual phenomenon, so the stories of people hearing sounds from the aurora and meteors catches my attention. Hearing a meteor doesn't seem very unusual until you think about it for a bit. If one were to see a meteor streaking across the sky in a science fiction movie, the Hollywood sound people probably couldn't resist putting at least a faint swishing sound along with the visual. Reports of hearing meteors go far back into history.

Nevertheless, as far back as 1719, Edmund Halley (as in Halley's Comet) realized that strange noises coincident with a large meteor fireball seen throughout much of England could not be transmitted instantaneously over distances in excess of 100 km. Even if the atmosphere was dense enough to conduct the sound, meteors start their fiery demise 60 or 70 miles up in the atmosphere. Sound travels at approximately 1 mile in five seconds (all you lightning watchers should know this) so even if an incoming meteor makes a sound, we wouldn't hear it until about five minutes later!

There is obviously another effect happening here than actual acoustical sound from the meteor. In addition, for years people have reported hearing the aurora, which has the same problem with distance and a thin atmosphere. There are even old Eskimo songs about the sound of the aurora. Brian Page pointed me to an article from NASA on "Hearing the Leonids", (http://science.nasa.gov/headlines/y2001/ast26nov_1.htm), which piqued my interest and inspired me to do some research.

The article states:

> All at once, there was an eye-squinting flash of light and a strange crackling noise. Puzzled sky watchers looked at one another ... and confessed: "Yes, I heard it, too."
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> Hearing meteors? It could happen -- and indeed, it did, plenty of times during this month's Leonid meteor storm. Just last weekend scores of people little inclined to fantasy heard the Leonids. The sounds weren't rumbling sonic booms or the loud crack of a distant explosion arriving long after the meteor's flash had come and gone. Rather, these were exotic, delicate noises, heard while the meteor was in full view. Scientists call them "electrophonic meteor sounds".
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> Meteor listeners have long been reluctant to report their experiences -- a result of Halley-esque skepticism. However, hearing a meteor doesn't mean you're crazy.

> Indeed, modern researchers are increasingly convinced that the electrophonic sounds are real.

The NASA article refers to the work of Dr. Colin Keay at University of Newcastle in Australia. Dr. Keay has been a leader in Electrophonics research. The article continues:

> According to Keay, glowing meteor trails give off not only visible light, but also very low frequency (VLF) radio signals. Such radio waves, which oscillate at audio frequencies between a few kHz and 30 kHz, travel to the ground at the speed of light – solving the vexing problem of simultaneity.
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> Of course, human ears can't directly sense radio signals. If Keay is right, something on the ground -- a "transducer" -- must be converting radio waves into sound waves. In laboratory tests, Keay finds that suitable transducers are surprisingly common. Simple materials like aluminum foil, thin wires, and pine needles -- even dry or frizzy hair -- can intercept and respond to a VLF field.
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> Here's how it works: Radio waves induce currents in electrical conductors. "Strong, low-frequency currents can literally shake ordinary objects," explains Dennis Gallagher, a space physicist at the NASA Marshall Space Flight Center. "When things shake, they launch vibrations into the air, which is what we hear."

The NASA article is a bit misleading. Dr. Keay's theory involves Bolides, large bright meteors that appear to explode. This type of meteor is more likely to produce fragments that survive the passage through the earth's atmosphere. These meteors are large enough to generate the RF energy that causes the electrophonic effect. However, a typical meteor shower, like the Leonids, is composed of "grain of sand" sized particles that burn up high above the earth, so what is going on here? Is there another mechanism involved here, or is the brain acting like a Hollywood sound effects person and applying a sound because it seems appropriate?

If meteors are emitting VLF signals, we should be able to hear them on whistler receivers. This shouldn't be confused with another method of detecting meteors by radio by listening for an over the horizon radio station to be bounced off the ionized meteor trails. The carrier of a distant television station in the 60 or 70 MHz range is often used, with brief bits of carrier being heard as each meteor ionizes the atmosphere.

Some of our members have listened during meteor showers over the years but not reported anything conclusive. However, there was an interesting study done several years ago. In the NASA archives at http://leonid.arc.nasa.gov/MS025.pdf, is a most interesting 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 receiver used two orthogonal loop antennas and was normally used for lightning research.

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 different from lightning pulses in the following ways:

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. I would guess that audibly, meteors sound like light sferics. Maybe we have been hearing them all along and didn't know it.

This of course, is one recording of one event, but recordings were made on nights when there was no meteor shower as a control and to differentiate bwtween meteor radiations and lightning. The authors state that there is no theory that describes VLF emissions for small meteors and that more study is needed.

Other researchers also advise more study before jumping to conclusions. Luigi Foschini at Institute TeSRE - CNR, Bologna (Italy), and Martin Beech at the Department of Physics, University of Regina (Canada) warn that caution is necessary before a new theory is formed. Just seeing a meteor and hearing a pulse does not necessarily mean that the two are causally related. Whistler receivers are awash with all kinds of electromagnetic pulses, and relating a specific pulse to a specific event elsewhere is not easy. Good science demands control data at times when showers are not active, and identification of unique meteor pulses that can be verified at different locations and under different conditions.

In summary, there are several theories for the production of VLF signals from bright meteors (Bolides). In any case, it would seem that with Dr. Keay's theory, any VLF signal capable of producing an electrophonic sound would produce a deafening signal in any Natural Radio receiver. While his theory is probably correct, there may be other mechanisms of generating an electrophonic sound. Could VLF sounds 20 db quieter than sferics generate an electrophonic sound?

In addition, there are reports of VLF signals being produced by meteors. Price and Blum's study describes the characteristics of the signals they observed, which gives us a good starting point for further observation. Opportunities for more observation and study abounds -- and that of course is where we observers and perpetual experimenters come in, and again the hobby gets more interesting.

Report From IMAGE Tests Bill Taylor writes, "No one has reported to me that they have detected the IMAGE transmissions. I suspect that sophisticated digital signal processing techniques will have to be used, perhaps similar to that used by radio amateurs for detecting weak LF transmissions."