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The Bulletin of the
Richmond Amateur Telecommunications Society
P. O. Box 14828 - Richmond, Virginia 23221

*Radio*Astronomy

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***"The sky is falling!"*—C. Little**

And it might appear just this way. The arrival of this year's Leonid meteor shower is met with great anticipation. Even though last year's show was impressive, this year's could be the one every stargazer waits a lifetime to see—a meteor *storm*.

The last time the Leonids produced a storm was on November 17, 1966, the greatest meteor shower ever recorded and centered over the nighttime skies of the central and western United States. Meteors were seen to fall "like snowflakes." At its peak, meteors at the rate of 40 *per second* were observed.

In 1933, one witness described that year's shower as being "like a child's sparkler held in the sky."

Annual meteor showers, and there are several each year, occur when the earth passes through the debris trail left by a comet. The one responsible for the Leonids is Comet Tempel-Tuttle with a period of 33 years. The Leonids have produced significant fireworks in a mostly predictable pattern since 1799. These storms were also observed in 1833 and 1866 as well as 1933 and 1966. 1899 produced a more mundane shower, and 1933's November show was weaker than anticipated, but had its moments.

The 1999 rendezvous was far short of the 1966 blitz, but still impressive. Some observers saw a rate of about one per second at the peak.

Occasionally, during the year of an anticipated storm, Saturn and/or Jupiter passes through this trail of debris ahead of the earth. The gravitational effects of these massive planets either "sweep" the trail clean or deform it in such a way that before the earth can get to it, the debris is gone, and we are disappointed.

You can sort of think of a periodic comet such as Halley or Tempel-Tuttle as a speedboat making laps around a lake. The boat leaves a persistent wake.

RATS ONLINE MEMBERSHIP DATABASE EXPLAINED IN NOVEMBER

Jim Stallings, KD4ZOT, will present a tutorial on the use of the RATS Online Membership Database. He will show you how to navigate the database, make corrections and indicate membership preferences.

This is an invaluable tool for the club, and maintaining correct data is essential to getting information properly distributed to members. Addresses for mailing issues of *Solid Copy* and distributing Repeater Codes and *Frostfest* information come from this list.

Election results will also be announced and winners will be sworn into office.

NEW RATS MEETING TIME

Monthly meetings of the Richmond Amateur Telecommunications Society will begin at 7:30 PM starting this month.

With meetings lasting until nine-thirty and beyond, eight o'clock start times have proven to be too late—especially for those with long drives home. So plan now to come earlier.

RATS meet every third Friday of the month at the West End Volunteer Rescue Squad, 1802 Chantilly Street, Richmond.

Coming from either direction on Broad Street, Chantilly is the first intersection east of Staples Mill Road. The WEVRS building is 1/2 block south of Broad on Chantilly.

Periodically (in our comet's case every 33 years), the boat comes back around to make another wake. These wakes will not be exactly superimposed one upon the other because the boat's path may not be over the exact same spot or the water may drift. These wakes correspond to the debris trails of the comet—dust particles and ice crystals. When our little boat passes near one of these wakes we feel it as rocking. This can be gentle or violent, depending on how close we are to the wake. Likewise, the earth will experience a typical meteor shower or a storm, depending on how close we get to the debris trail.

This Year's Show

On the night of November 18th—19th we will pass *through* two of these "wakes." At 04:03 UT on November 19th the earth will pass through the debris field produced by the 1767 perihelion. This one will best be seen in Western Europe and Africa. Six hours later the earth enters the debris field of the 1866 approach. That's our show. At 10:40 UT the view will be best from the United States. That will be 5:40 AM for us. But don't limit yourself to such a precise time. Meteor activity should increase in the days and, especially, hours approaching this peak, then wane similarly. I would begin observing at least an hour before and continue until dawn.

What might we expect? Meteor shower intensity is measured in a metric called the zenithal hourly rate (ZHR). This is what a hypothetical observer can see in a dark, moonless sky in one hour. Well, in this day and age, who has access to a dark sky? Maybe if you live waaay out in the boonies. But even then, it's likely someone has civilized it by putting up a guard light. Anywhere near a city compromises this view so the ZHR is an idealized concept.

For the two dust trails the earth passes through on the 19th the ZHR is predicted by the top three meteor shower prognosticators variously to be 2,000 to 5,000 for the 1767 (western Europe) trail and 3,000 to 10,000 for the 1866 (U.S.) trail.

Radio???

Now this may all be very interesting, but what does it have to do with amateur radio? If you've ever tried to work weak signal VHF/UHF—in this case, meteor scatter—and found it challenging, if not down right impossible, then this might be your best shot at success.

Meteor scatter (MS) is a propagation mode using the ionized trail of meteors to reflect VHF and UHF signals. Expect your ranges to be increased to the 600 mile to 1,200 mile distances. If you can achieve multi-hop propagation, even that distance might be well exceeded (best on six meters). Your contacts could extend well into Canada and the Midwest. This will be E-Layer propagation at a height of about 65 to 68 miles. The ZHR mentioned above is for visible meteors. Some clouds or a bright moon or city lights? Radio doesn't care about what you can see. If this shower is anything like it's hoped to be, there'll be a whole lot of ionizing going on.

MS is done on 28 MHz and higher frequencies. Six meters seems to be the band of choice, but it is also done on 2 meters and into the UHF bands, but becomes more difficult, the higher in frequency you go. You also need power and a beam antenna. SSB and slow (below 50WPM) CW are used, but the preferred mode these days is HSMS or HSCW. This high speed meteor scatter mode takes advantage of your computer and its sound card by employing free software like WSJT or MSDSP and an interface to connect your computer's sound card to your radio. Many of you already have the interface if you work things like PSK-31.

The ionized trails left by a meteor may last from to one or two seconds to a minute or more in duration. It is for this reason that any proposed communication in this manner must be very efficient—very quick. That's why HSMS is the preferred method. This uses CW sent, not at 30 or 40 or 50 words per minute, but usually 4,000 to 6,000 letters per minute and can be as high as 10,000 lpm! That's the reason for the computer and special software.

Protocol is Important

Coupled with the high-speed transmissions is the economy of characters sent. No "CQ" or "de" or anything unnecessary to the contact is used. Only the call signs of the two stations in QSO with each other, a special signal report and confirmation are exchanged. As you will see it is very important for all station clocks to be precisely matched to Universal Time. For example, station KZ5ABC initiating a contact with WY4XYZ:

"WY4XYZ KZ5ABC WY4XYZ KZ5ABC WY4XYZ KZ5ABC . . ." string repeated for one minute.

If WY4XYZ copies both calls, he returns the calls with a signal report:

"KZ5ABC WY4XYZ 27 27 27 KZ5ABC WY4XYZ 27 27 27 KZ5ABC WY4XYZ 27 27 27 . . ." string repeated for one minute.

The first digit of the report is the reception burst length followed by the signal strength. Numerals 2 through 5 represent five seconds or less, from five to 15 seconds, from 15 to 60 seconds and above one minute in length, respectively. Signal strength represented by digits 6 through 9 to indicate S3 or below, S4 to S5, S6 to S7 and S8 or above, respectively. If you copied one of the digits, but not the other, you know what data is being sent by its value. A six only applies to signal strength; it does not exist for burst length.

Now that the stations have exchanged call signs, they are dispensed with (only if the QSO lasts beyond 10 minutes—and they often last more than an hour—will you insert your call as you would with any QSO). If the first station has now copied his contact's call, heard him return his own call and signal report, he returns his signal report with a 'roger':

"R26 R26 R26 R26 . . . " string repeated for one minute.

Once a signal report is sent, it is not changed—even if it improves. To change it would be to inject confusion into an already difficult exchange.

Information confirmed received is not sent again. After the second station gets his report, he sends his rogers:

"RRRRRRRR . . ." string for one minute

When the first station hears the string of R's he can confirm with another string of R's or 73's to end the QSO. For the QSO to be complete each station must have the other's call, his own call returned, signal report and verification that the other station has done likewise.

Of course this is the perfect QSO. Normally the transmissions are fragmented due to the nature and brevity of the meteor trail reflections. That's why information is repeated so much—to enhance the probability that the receiver will get some part of the information completely or be able to piece together different fragments to identify the call sign and or signal report It's also why they can last so long.

Often times you miss a part of the information you need. If you miss the other stations call sign you send a string of Y's (your). If he has not returned, or you have not copied your own call sign, send a string of M's (mine). Need a signal report? Send a string of S's. If both call signs have not been received, a string of B's is sent. If his transmission is totally unreadable, use a string of U's.

No extraneous data is sent. Only the character string for data requested, and in response, only the data asked for—nothing else.

To further minimize the chaos that could appear, westernmost stations initiate the contact and transmit (toward the east) during the first transmission period at the top of the hour (this is reverse of the protocol in other IARU regions). In the US that period is for one minute. You would know this if a sked has first been established. These days with Internet and email this is easily accomplished, but can also be done via HF or telephone or traditional mail. If both stations were on or very near the same line of longitude, then the southernmost station would be the first to transmit (in a northerly direction).

If you don't have a schedule set up, random CQ'ing can be done beginning at the top of the hour with the presumption that you are the westernmost station, even though you may not be.

Calling frequencies for such random contacts are 144.100MHz zero beat for HSMS or 144.200MHz for SSB on two meters. For six meters it's 50.300MHz on HSMS.

You can add a letter to your CQ call to indicate you are listening up a number of KHz and you expect the QSO to take place there on simplex. As soon as a response is received, the initiator moves his transmissions there as well. Each letter suffix represents one kilohertz in frequency. For example:

CQA=Up 1KHz
CQB=Up 2KHz
CQZ=Up 26KHz
CQAA=Up 27KHz
Etc.

If you happened to be working slow speed CW (50 WPM or less) or SSB the sending periods are shorter. For SSB it is 15 seconds beginning at the start of the each minute. Slow CW may use sending periods of 15 seconds, 30 seconds or one minute. This protocol would have to be established before the QSO when you set up the sked.

A last bit of information that may be exchanged in contest work is your QTH in the form of a grid square location.

Unfortunately there is not space enough here for a real tutorial, but hopefully enough to pique your interest to try meteor scatter this month and/or in the future. For more information see November's *CQ* and *Astronomy* (US version) magazines or visit the follow web pages:

For Time Synchronization

http://www.worldtimeserver.com/atomic-clock/
http://www.time.gov/
http://atomtime.com

For Leonids

http://www.space.com/leonids/
http://star.arm.ac.uk/leonid/index.html
http://science.nasa.gov/headlines/y2002/09oct_leonidsforecast.htm

For MS and Software

http://www.nitehawk.com/rasmit/HSCW-SOP.html
http://www.qsl.net/k0sm/ms1.htm
http://www.nitehawk.com/rasmit/hscw_files.html
http://www.vhfdx.de/

OCTOBER MEETING

Guy Carlsen, K4CNF, presented a video detailing a fascinating look at the VKØIR Heard Island DXpedition. This expedition has become the benchmark for those who have followed. The concept of pilot operator was first used here as well as online logging.

VE EXAMS

Exams for licensing or upgrading to the end of the year are as follows. To take an exam you must bring $10.00 cash (exact change) and two forms of identification, one of which must be a photo I.D. If you are upgrading you must bring the original of your current license *and* a photocopy of same. If you have credit for previously passed element(s) bring your CSCE. Please arrive about 15 minutes prior to the indicated time below.

Preregistration is preferred, but not required. Walk-ins are welcome as long as seating and materials are available.

The only exam until the end of the year is on December 14th at 9:00 AM at J. Sargeant Reynolds Community College, 1651 E. Parham Road, Richmond, in Building B.

For more information or to preregister contact Patrick Wilson, W4PW, (804) 932-9424 or go to:

http://www.w4pw.org/hamtests.htm

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