Detection of 2004 Leonid Meteor Shower from Kolkata through its Effects on VLF Transmission

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Using a VLF amplifier tuned at one of the transmission frequencies of Indian Navy Traffic stations at Vijayanarayanam ($8^0 25'' 59.88''$ N, $77^0 48'$ E) at 16.3 KHz, we observed Leonid Meteor Shower at Kolkata ($22^0 34'$ N, $88^0 30'$ E), India. The shower was predicted to exhibit a peak activity on 19th November 2004. In spite of low ZHR predicted, we observed the peak activity earlier than the predicted times which confirms the nongravitational 'A2 effect' on meteoroids trails. Our observation also suggests that electromagnetic detection of meteor shower is better than the visual observation because a shower can also be detected during daytime and in such places where visibility is very poor.

Leonid meteor showers are observed around 14th to 20th November every year. It was thought that the Leonid period was over after 2002 but there was a fair activity in 2003. For 2004, another activity was predicted. Not a storm level, but the Earth was predicted to pass close to two streams: the 1333 and the 1733. The 1733 stream was already encountered in 2002 and the 1333 stream was thought to be responsible from the 1998 storm, but not all models agree about that. Nevertheless, the three current models all agreed to have some Leonid activity on 2004.

It was predicted that any outburst from the 1333 trail will peak at 06:42 UT, November 19. Rates would not be high, ZHR = 10 at best. The second 1733 trail would arrive at 21:49 UT, when the rates could go up as high as ZHR = 65. Even though predicted rates were not as high as in past Leonid storms, it was important to continue observing these showers to learn how dust is distributed by the parent comet 55P/Tempel-Tuttle.

We are continuously recording a VLF signal at 16.3 KHz which is transmitted by VTX1 Indian Navy station located at Vijayananarayanam which is about 2000 km. away from Kolkata. Continuous recording enables us to monitor ionospheric disturbances due to lightning activity, solar flare etc. The sunrise effect on VLF signal is also very prominent at Kolkata. Recently we tried to observe the effect of recent Leonid meteor shower on the propagation of VLF signals. Interestingly, we not only detected the shower but also confirmed the nongravitational 'A2 effect' on Leonid meteor trails. The enhancement of signal strength due to the shower was around 10 db accompanying many micro-pulsations averaging 0.99 db.

Detection of meteor shower by electromagnetic signals is very effective since the presence of a shower can also be detected during daytime unless there is severe thunderstorm activity. If the system is properly designed, it is also useful in detecting very weak or low ZHR meteor showers which are not detectable with visual observation even at night. It was daytime when the first shower occurred 19th November at 1212 hr local time. Nevertheless we successfully observed it using electromagnetic method. To confirm nongravitational 'A2 effect', we think simultaneous observations synchronized with time at different places are necessary.