

Hook Whistler—a New Equatorial Whistler observed by *Injun 3*

THIS communication reports a new type of whistler discovered in the very low frequency radio noise data from the *Injun 3* satellite. (See ref. 1 for details on the *Injun 3* very low frequency experiment.)

Spectrograms of frequency against time for the new whistler are shown in Figs. 1 and 2. We have called this whistler the "hook whistler" because of the similarity of its frequency-time plots to a type of very low frequency emission called a hook². The hook whistler consists of two whistler-like components separated by a frequency dependent time delay of 0-200 msec. The difference in time delay between the two components of a hook whistler typically decreases to zero at a frequency of about 1.0 kc/s, giving the impression that the two components join at this frequency as illustrated in Fig. 1.

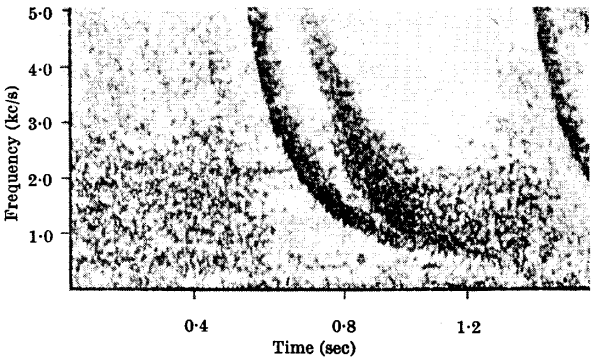


Fig. 1. January 7, 1963. 09h 48m 10s U.T.; altitude, 2,633 km;
 λ , 21.0°; B, 0.119; L, 1.62; Lt., 3.73h.

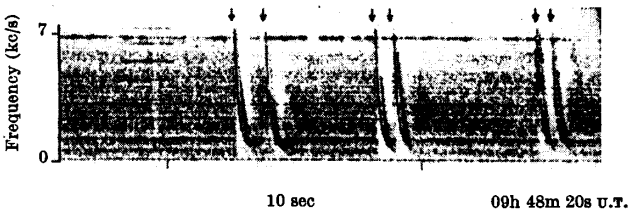


Fig. 2. January 7, 1963. Altitude, 2,617 km; λ , 11.9°; B, 0.118;
L, 1.60; Lt., 3.8h.

It is thought that the two components of the hook whistler originate from the same lightning impulse rather than from two independent impulses because of the repeated occurrence of hook whistlers with nearly the same time delay between the two components. Fig. 2 shows six successive hook whistlers which occurred within a time interval of about 20 sec. All six have the same frequency-time spectra within the accuracy of the measurements of the spectrogram. We believe that it is highly improbable that the whistlers shown in Fig. 2 could have originated from six pairs of lightning impulses with the time delay between elements of each pair being essentially the same in each case. It seems much more plausible that the two components of a hook whistler originate from the same lightning impulse and that they arise from different propagation paths from the lightning source to the satellite.

A preliminary study of the *Injun 3* data has shown that hook whistlers are found for all altitudes sampled by *Injun 3* (240 km–2,780 km altitude), for all local times, and principally near the magnetic equator (less than 40 degrees magnetic latitude). A more complete investigation of the occurrence of these unusual whistlers is being conducted. The theoretical explanation of these whistlers is being sought by one of us (S. D. S.) using computer ray tracing techniques.

This work was supported in part by a contract with the U.S. Office of Naval Research.

D. A. GURNETT
S. D. SHAWHAN
G. W. PFEIFFER

Department of Physics and Astronomy,
University of Iowa,
Iowa City, Iowa.

Received November 14, 1966.

¹ Gurnett, D. A., and O'Brien, B. J., *J. Geophys. Res.*, **69** (1), 65 (1964).

² Gallet, R. M., *Proc. Inst. Rad. Eng.*, **47**, 211 (1959).