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Enhancement of Cosmic Noise at 18 Megacycles per Second Following the Starfish Test

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Abstract. We report low-latitude 18-Mc/s radiometer observations of the high-altitude nuclear test explosion of July 9, 1962. The stations were Baguio City, Philippines; Honolulu, Hawaii; and Boulder, Colorado, at geomagnetic latitudes 5°, 21°, and 49°N, respectively. No effects, neither absorption near the time of the explosion nor subsequent emission, appeared at Boulder. Enhancements by factors of 2.0 and 1.1 over the normal galactic level were observed at Baguio and Honolulu, respectively, at 2100 hours sidereal time and within a broad area of the sky centered near +10° declination. The corresponding decay rates were about 1 and 2 months. The low-latitude decay is significantly more rapid at 18 than at 30 Mc/s as reported by Ochs et al.

As one of its programs supporting the International Geophysical Year, the High Altitude Observatory constructed a number of radio receivers designed to detect solar flares indirectly through their ionospheric absorption effects. Under the direction of *Robert H. Lee* [1957], five of these radiometers were ultimately built, all operating at about 18 Mc/s and located at Baguio, Honolulu, Boulder, Lake Angelus (near Pontiac, Michigan), and Rome. The stations at Baguio and Honolulu are close enough to the geomagnetic equator to lie substantially underneath the electrons trapped in the earth's magnetic field after the Starfish explosion. This report summarizes observations of the cosmic noise enhancement produced by synchrotron emission from these electrons. Unfortunately, the Baguio equipment did not go into operation until early 1962. This fact limits our report to only the first 2 months' data following the explosion at 0900 UT on July 9, 1962.

Figure 1 shows the geometry of the earth's magnetic field and the two low-latitude stations in our network. The assumed position of the blast, 400 km above Johnston Island [*Brown et al.*, 1963], is indicated on the figure. Also shown are the half-power antenna beamwidths. The exact antenna configuration is given by *Steiger and Warwick* [1961]. From the figure we see that the antenna beams overlap only above 2400-km elevation. Also, the average direction of the antenna patterns lies at about 90° to the lines of force over Baguio but only at about 45° over Honolulu. The magnetic field is assumed to be an off-center dipole field, with field strengths as given by *Vestine and Sibley* [1960]. Baguio, Johnston Island, and Honolulu are represented on the figure at their proper geomagnetic latitudes, but (incorrectly) along the 150°W meridian.

Figure 2 shows records from the three stations at the time of the Starfish explosion. At Honolulu, a strong absorption effect, off-scale at about 22 db, appears at the moment of the explosion, and immediately, within a time constant of 0.2 second, begins recovery. Boulder shows neither emission nor prompt absorption effects. The latter contrasts with the prompt ionization recorded at Alaska [*Basler et al.*, 1963]. At Baguio, within a very few minutes, the 18-Mc/s level of cosmic flux begins to rise and, after some fluctuations, reaches a steady enhanced value by 1000 UT.

Figure 3 presents the reduction of our records to receiver power levels, in terms of noise diode current on an arbitrary scale. They have been