

The Crying of Bats

Biologists have known for some time that bats guide their flight through darkness by means of special cries which are above the frequency range of human hearing. A recent detailed acoustic analysis of these ultrasonic sounds shows many similarities to radar and sonar systems. The sound is emitted in pulses lasting only about two milliseconds. Pulse repetition rates may be at least as high as 50 per second; but there is a relatively long, silent period during which the bat can listen for echoes. The frequency of the sound varies during each pulse, starting typically at about 80 kilocycles per second and dropping to 40 at the end of the brief burst of sound. Since the pulses are undergoing this frequency modulation there is no single frequency which can properly be assigned to the cry.

For the species studied to date the maximum energy is contained in the middle of the pulse where the frequency is between 50 and 60 kilocycles. The sound pressures developed are surprisingly high: a microphone 10 centimeters in front of a bat's mouth will often record sound pressures of 60 dynes per square centimeter at 50 kilocycles, or 109 decibels on the customary scale of sound level. Such sound levels are characteristic of the cabins of very noisy combat airplanes; yet the bat produces this sound intensity by means of a specialized larynx which is only about five millimeters in its largest dimension. Ordinarily one notices no sound as a bat flies past emitting these ultrasonic pulses, but in a very quiet room a faint click may be audible. This results from the presence of a very low amplitude component in the pulse, having a frequency of roughly 10 kilocycles. This 10 kc component has only about one thousandth of the amplitude of the 50 kc waves; yet because the latter are so intense, the weak component is the only audible portion of the pulse.

The entire process of orientation by means of echoes is worthy of more attention than it has yet received in view of its probable usefulness to blind men, its analogies to instrumental developments allied to radar and sonar, and its highly perfected development in bats.

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Measurements of the Ultrasonic Cries of Bats. By Donald R. Griffin. *J. Acous. Soc. Am.*, 22: 247, March, 1950.

Advertiser Killer

This article describes a simple electronic device for protecting the radio listener from the interminable razzle-dazzle of radio advertising. At a hand-clap, or other sharp sound, the radio becomes silent and remains so for a definite predetermined time interval. The circuit is described in detail, together with its operation and the controls necessary to make it function as a useful ever ready adjunct to a radio. The sound signal enters a collecting

horn fitted to a carbon microphone whose output is amplified and fed to the grid of a gas triode acting as trigger to a time-delay circuit. By means of a relay, the time-delay circuit merely opens the loud speaker line and keeps it open for the pre-set time interval.

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New Application: Electronic Time-Delay Circuit. By I. Clyde Cornog. *Am. J. Phys.*, 18: 62, February, 1950.

Deuteron Disintegration

One of the central problems of nuclear physics has been the determination of the potential acting between two nucleons in the state of zero relative angular momentum (S state). This potential determines almost entirely the characteristics of nuclear two body systems at low energies. On the other hand, it has long been thought that the low-energy experimental data does not determine the potential completely.

In a previous paper (H. A. Bethe, *Phys. Rev.* 76: 38, July, 1949) it was shown that S-state scattering data (including the energies of bound states, if any) can be analyzed exactly in terms of two parameters. One of these parameters describes the system at a fixed energy: e.g., it may refer to the scattering cross section at zero energy. The other parameter is called the "effective range" of the potential; it would be zero if the two nucleons interacted only at a point, and is in general larger for potentials of longer range. Although the effective range is not identically independent of the energy, it was shown in the earlier paper that it is almost so for low energies and for any likely potential. The theory was found to fit the neutron-proton and proton-proton scattering data.

In the present paper it is shown that photo-electric and photo-magnetic disintegration of the deuteron depend to good accuracy only on the binding energies of the deuteron (the binding energy is fictitious in the 3S state) and on the effective ranges in the two spin states 1S and 3S . The low energy data (in their present accuracy) therefore give only the strength and range of the S-state potential, and give nothing further about its shape. However, it is noteworthy that a "longtailed" potential, such as the Yukawa meson-theoretic potential, is required by the data if one postulates that the neutron-proton and proton-proton potentials have the same shape and range in the 1S state.

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The Effective Range of Nuclear Forces. II. Photo-Disintegration of the Deuteron. By H. A. Bethe and Conrad Longmire. *Phys. Rev.*, 77: 647, March 1, 1950.

Fine Lines in Soot

During an investigation of the friction of rolling it was desirable to have a simple and direct method for recording frictional data. The old method of recording with a stylus in soot on glass was tried, but the piling up of soot on the stylus point seldom produces lines narrower than 0.1 millimeter. If, however, a hydrocarbon such as kerosene is introduced into the soot by capillary action the soot is more firmly bonded to the glass base and a