210-ft. telescope. Sources of flux density greater than 4×10^{-26} W m^{-2} (c/s)$^{-1}$ were afterwards observed at 22 and 11 cm. The catalogue comprises 300 objects with galactic latitude greater than $\pm 10°$ and of these 230 occur in the MSH catalogue. On linear extrapolation of the spectra defined by the 22 and 75 cm measurements, some 50 would be below 15×10^{-26} W m^{-2} (c/s)$^{-1}$ at 3·5 m and thus might not be expected in the MSH catalogue. On the same basis, the other 20 would be well above the lower limit of the MSH survey. The absence of a few of these could be due to their proximity to side-lobe regions of the cross-aerial associated with strong sources. However, the remainder could be explained in terms of strong curvature in their spectra between 75 cm and 3·5 m. For 3 out of the 230 sources common to both surveys there is reasonably direct evidence of maxima in the spectra in the decimetre wave-length range. It seems, therefore, that the frequency of occurrence of objects such as *CTA* 21 and *CTA* 102 lies somewhere between 1 and 6 per cent and thus they should not have a significant effect on source counts.

The most unusual case we have of a curved spectrum (Fig. 1) is that of the source which we have designated 1934–63. Its co-ordinates are:

R.A. 19h 34m 46s ± 4s (1950)
δ $-63° 49{\cdot}4' \pm 0{\cdot}5'$

Between 10 and 50 cm the flux densities were measured relative to Hercules-*A* as the two were comparable in this range; above 70 cm they were measured relative to a nearby source, MSH 19–56, which has about the same flux density at 75 cm and has a well-defined power-law spectrum. The angular size of the source is not known, but as it does not noticeably broaden the aerial beam at 11 cm it must be less than 2′ of arc. Linear polarization is less than 2 per cent at 11 cm and less than 1 per cent at 22 cm. A 74-in. plate taken by Dr. Bengt Westerlund at Mount Stromlo Observatory shows no prominent visible counterpart for the source although there are several galaxies of about eighteenth magnitude in or near the error area.

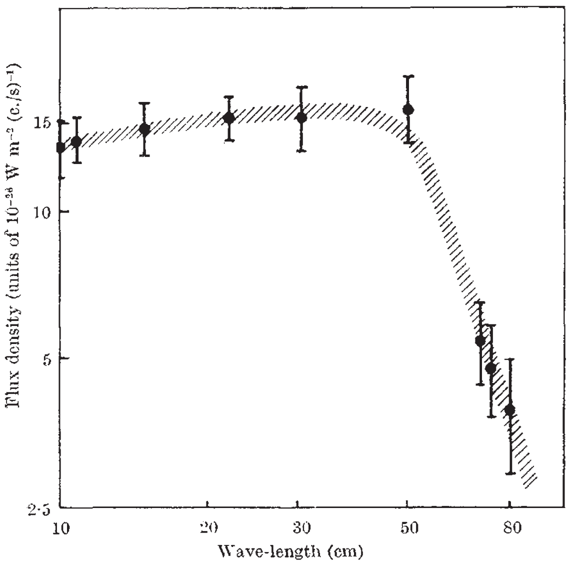

Fig. 1. Radio spectrum of the source 1934–63. Both scales are logarithmic

The marked difference between the spectra of *CTA* 21 and *CTA* 102 and this new object lies in its extremely sharp long-wave-length cut-off. The gradual slopes of *CTA* 21 and *CTA* 102 are just consistent with the assumption of radiation from an almost mono-energetic electron spectrum. With 1934–63 the sharp cut-off appears to rule out an origin solely in an emission process and suggests the presence of an absorbing or reflecting medium in front of a normal non-thermal source. Even in this case extremely high values of optical depth or plasma critical frequency are required. A knowledge of the angular size and thus surface brightness temperature is required before possible models can be profitably investigated.

J. G. Bolton
F. F. Gardner
M. B. Mackey

C.S.I.R.O.,
Radiophysics Laboratory,
University Grounds,
Sydney.

[1] Conway, R. G., Kellerman, K. I., and Long, R. J., *Mon. Not. Roy. Astro. Soc.*, **125**, 261 (1963).
[2] Harris, D. E., and Roberts, J. A., *P.A.S.P.*, **72**, 237 (1960).
[3] Edge, D. O., Shakeshaft, J. R., McAdam, W. B., Baldwin, J. E., and Archer, S., *Mem. R.A.S.*, **68**, 37 (1959).
[4] Mills, B. Y., Slee, O. B., and Hill, E. R., *Austral. J. Phys.*, **11**, 360 (1958); **13**, 676 (1960); **14**, 497 (1961).

PHYSICS

Stimulated Compton Scattering of Electrons by Standing Waves of Light

The production of very intense visible radiation by lasers has facilitated investigations of the interactions between photons and electrons. A recent communication shows that for the case of a beam of multi-GeV electrons incident head-on upon a ruby-laser beam, Compton scattering produces an appreciable quantity of high-energy scattered photons, which largely preserve their initial polarization[1]. Thomson scattering of a laser beam by a beam of 2-KeV electrons has been observed experimentally[2].

It is interesting that, thirty years ago, Kapitza and Dirac calculated the probability of reflexion of very-low-energy electrons from standing waves of light[3]. Because the standing wave-train gives rise to stimulated Compton transitions, Bragg's law is obeyed, one-half the light wave-length being equivalent to the lattice spacing. This, of course, is a non-linear effect distinct from that cited in the previous paragraph. Using Thomson's formula, the probability of an electron being deflected is shown to be:

$$\frac{e^4 L}{2m^2c^2h^2\nu^4 v}\int I_\nu I'_\nu d\nu$$

L is the length of the electron path through the light beam and v is the electron velocity. I'_ν is the energy of the stimulating beam per unit area per unit time per unit frequency-range. I_ν is the corresponding quantity for an element of the incident beam, the total energy per unit area per unit time of which is $I_0 = \int I_\nu d\nu$.

It was concluded by the authors that the experiment could not be made with the apparatus then available. For example, the probability of deflexion of 25-eV electrons from standing waves produced by a mercury arc delivering 1 W at 5461 Å with a band-width of 0·1 Å is about 10^{-14}.

The probability depends on the square of the intensities, however, and the advent of lasers would seem to bring the experiment within range of possibility. Using values characteristic of ruby lasers produced commercially—power output 10 kW and line-width of 0·04 Å—the probability of electron deflexion is increased to the order of 10^{-7}. Experimental problems, while far from trivial, appear to be surmountable. The primary and deflected beams lie very close together, and separating them may be somewhat difficult.

I thank the Socony Mobil Oil Co., Inc., for permission to publish this communication, and Prof. Richard H. Milburn for criticisms and suggestions.

A. C. Hall

Socony Mobil Oil Co., Inc.,
Field Research Laboratory,
Dallas, Texas.

[1] Milburn, R. H., *Phys. Rev. Letters*, **10**, 75 (1963).
[2] Fiocco, G., and Thompson, E., *Phys. Rev. Letters*, **10**, 89 (1963).
[3] Kapitza, P. L., and Dirac, P. A. M., *Proc. Cambr. Phil. Soc.*, **29**, 297 (1963).