sity's meteorological laboratories which are now charting air currents on the outdoor campus.

THE trustees of the Rockefeller Foundation have made a conditional offer of £60,000 to aid the National Hospital, London, a leading center for the treatment and study of nervous diseases. The money is to defray the cost of new buildings and equipment on the condition that the balance required, estimated at £120,000, is raised within two years. If the condition is fulfilled, the trustees will give a further £60,000 toward an endowment for research.

THE London *Times* reports that the Danish government's scientific expedition ship *Dana* sank recently in the North Sea sixty miles west of Ringkjöbing, Jutland, after a collision in thick fog with the German trawler *Pickhuben*. The leader, Dr. Vedel Taaning, and the crew, in all twenty-two men, were saved by the *Pickhuben* and brought to Esbjerg. The *Dana* was the ship used by the late Professor Johannes Schmidt, as director of the physiological department of the Carlsberg Laboratorium, on oceanographic expeditions to trace the migration of eels. Oceanic life was studied at the greatest depths with special echo-sounding gear, which is now lost, together with the results of expeditions during the last three years.

DISCUSSION

THE BORN THEORY OF THE ELECTRON

THE theory of the electron as formulated by Dirac has been especially successful in its application to atomic physics. However, when it comes to a treatment of phenomena in which the scale of the quantities involved in the calculations are of a lower order of magnitude than those considered in atomic physics, then discrepancies occur. This is readily understood when it is remembered that the Dirac equations are founded on the concept of a point electron. Born[1] has attempted to remedy the situation by replacing the concept at the basis of the classical electron of Lorentz by another set of fundamental ideas. As yet there is much discussion of the validity of his hypotheses. Perhaps the best test of any theory is the comparison of its predictions with experiment. In this note we shall give the results of the investigation of one of the properties of the Born electron. Before we discuss this we shall review briefly some of the other properties of the theory as they have a bearing on the problem.

(a) The Born electron has a finite mass. This is a property which any theory of the electron must guarantee.

(b) The theory requires that the effective electric intensity for electric waves of wave-length less than the radius of the electron be an average of the true electric intensity over the electron. In calculating problems in quantum mechanics involving electric waves of this character, the theory supposes that the equations of Dirac be used with the effective electric intensity substituted for the true intensity.

(c) This is the problem where the deviations from the classical theory are the most striking. The Born electron has properties which correspond in the theory of ponderable media to a dielectric constant and magnetic susceptibility. The field equations are non-linear. This results in the effective electric force acting on an electron in an intense electric and magnetic field being proportional to the sum of two terms: in the one, the electric intensity is the predominating term; in the other, the magnetic intensity. As a consequence of this, the effective electric force acting on an electron in a strong electric and magnetic field is greater than the force arising from the effect of the electric intensity alone. A situation where these considerations are important is in the problem of the production of photons by a high energy electron impinging on a nucleus. In the solution of this problem one method is to choose a system of axes in which the electron is at rest and then to consider the field of the nucleus acting on the electron as a system of electric waves. The scattering of the waves by the electron has for an observer at rest with respect to the nucleus the effect of the emission of radiation. According to this theory, the probability of the emission of two photons simultaneously is to the emission of one photon as the ratio of $2\pi e^2$ to hc where e is the charge on the electron, h Planck's constant and c the velocity of light. This ratio is equal to 1/137. Hence the chance of two photons being emitted simultaneously is negligible. On the Born theory, however, the increase in the effective electric intensity in those regions where the electric and magnetic fields are strong results in an increase of this ratio to $2\pi e^2\varepsilon/hc$ where ε is greater than one. If Z is the atomic number of the nucleus struck by an electron of kinetic energy ξ as measured in units of mc^2 then the production of small showers, *i.e.*, the simultaneous emission of two or more photons at a collision, should occur when the following relation is satisfied: $2\times10^3 \leqq Z\xi \leqq 2\times10^4$. This relation requires that the showers should be softer the heavier the nucleus involved in the collision. Such a theory also would require a revision of the theory of the hyperfine structure of spectral lines. We merely mention these illustrations to show where we may

[1] M. Born, *Proc. Roy. Soc.*, A 143: 410, 1934; M. Born and Infeld, *Proc. Roy. Soc.*, A 144: 425, 1934.

expect alterations in the current theory if a non-linear theory is correct.

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THE QUESTION OF WILDLIFE DESTRUCTION BY THE AUTOMOBILE

IN connection with the steady increase in the volume of automobile traffic in recent years considerable attention has been given to the killing of animals straying on or deliberately crossing the highways in search of food, water or other environmental requirements. In previous issues of SCIENCE observations on the extent of such destruction have been reported. Stoner,[1] 1925, observed 225 dead animals on the highway in Iowa during a three-day trip of 632 miles. Davis,[2] 1934, reported the destruction of 179 animals in two days on a stretch of 500 miles enroute from Iowa to Amherst, Massachusetts. These two observations each indicate an average of .36 dead animals per mile. This appears to be an alarming rate of destruction. Nor is the bulk of this killing confined to cats, dogs and fowls. Stoner lists 28 species, and instances of killing such large animals as a deer are known.

In the light of these facts an observation made on a 1,500-mile trip from Chicago, Illinois, to Woods Hole, Massachusetts, from June 26 to July 1, 1935, and on a return trip of 1,050 miles from Woods Hole to Cincinnati, Ohio, from September 1 to 4, 1935, appears to be particularly interesting. The following dead animals[3] were seen on or at the side of the road.

1. Cat (*Felis domestica*)	3
2. Chipmunk (*Tamias striatus*)	1
3. Dog (*Canis familiaris*)	5
4. Muskrat (*Ondatra zibethica*)	1
5. Rabbit (*Sylvilagus floridanus*)	3
6. Rat (*Rattus norvegicus*)	2
7. Skunk (*Mephitis nigra*)	8
8. Squirrel (*Sciurus carolinensis*)	1
9. Squirrel (*Sciurus niger*)	1
10. Downy woodpecker (*Dryobates pubescens medianus*)	1
11. Flicker (*Colaptes auratus luteus*)	1
12. Fowl (*Gallus domesticus*)	3
13. Robin (*Planesticus migratorius*)	3
14. Sparrow (*Passer domesticus*)	1
15. Garter snake (*Thamnophis sirtalis*)	3
16. Turtle (*Chelydra serpentina*)	2
17. Turtle (*Terrapene carolina*)	16
18. Unidentified	6
Total	61

[1] Dayton Stoner, SCIENCE, 61: 56–58.
[2] Wm. H. Davis, SCIENCE, 79: 504–505.
[3] Species according to H. S. Pratt, "Vertebrate Animals of the United States," Blakiston, 1935, and E. H. Forbush, "Birds of Massachusetts and Other New England States," Mass. Dept. Agric., 1925–29.

This total of 61 dead animals in 2,550 miles is an average destruction of .024 animals per mile, which is only one fifteenth the rate of killing reported by Stoner and Davis. On the basis that no carcass was more than 48 hours old when observed, the calculated rates of killing in the two cases, .36 and .024, indicate death rates of .18 and .012 animals per mile per day. Applying these death rates to the 750,000 miles[4] of hard-surfaced and improved roads in the United States produces an estimated killing of 135,000 animals per day, according to the Stoner and Davis figures, as compared with 9,000 per day on the basis of the present figures. Considering the great mileage of slightly traveled roads included in the total mileage and the close relation of speed and volume of traffic to rate of killing, it is believed that the lower rate of killing is too high for a daily nation-wide rate. Even at the higher rate, the killing, calculated for a corresponding period of time, amounts to only four fifths of the estimated annual (1935) slaughter of ducks alone, five to six million,[5] in a hunting season of thirty days.

From the author's point of view, *i.e.*, destruction of wildlife, the eleven cats, dogs and fowls listed are of no significance but are included for the sake of comparison with other such lists. Excluding these eleven animals from the calculations the observed death rate per mile per day for wildlife only is .0098, a rate which would produce an estimated daily destruction in the entire United States of 7,350 animals.

It is evident from the present observation that the automobile is not uniformly so great a menace to wild life as the death rate of .18 animals per mile per day, suggested by previous observations, would indicate. The Davis records of one dead rabbit per mile for 100 miles in Ohio or 200 dead animals in two miles of woodland road must be exceptional cases of destruction, at least as unusual as some may consider the present observation of only 61 dead in 2,550 miles. It is further indicated that the rate of killing may vary greatly from year to year, and also within a single season, probably in relation to marked departures from the normal temperature, humidity and precipitation, or in relation to seasonal activities of the animals. Hot dry summers, such as the seasons of 1933 and 1934, produce a definite alteration and limitation of the usual normal habitats and result in restless, exploratory activity on the part of the local fauna, bringing the animals into increased contact with the motor traffic on the highways. This movement, and accordingly the amount of killing, would be much less under the normal temperate conditions prevailing in the region surveyed

[4] U. S. Dept. of Agric., Bureau of Public Roads, Table M-5 (1930) and M-4 (1933).
[5] *Time*, August 12, 1935.