

Ball Lightning and After-images

ARGYLE¹, in writing from a distinguished observatory, suggests that observations of ball lightning are optical illusions, and also claims that he has "found it easy to simulate with light bulbs" a phenomenon which he has apparently never witnessed and the reports of which he is not prepared to accept.

No one will deny the existence of after-images and most people have experienced them on several occasions, but after-images which appear to more than one differently sited observer to have precisely the same form and to travel the same path; which clearly emerge from doorways, are occulted by nearby objects, yet obscure those just behind; which have angular diameters increasing from five or six degrees to over twenty degrees as they pass from over two metres to within fifty cm of the observer², require remarkable properties of the retina or extraordinary hallucinations on the part of the observer.

When I recorded an observation of ball lightning² I did not mention that my account tallied precisely with that of the only other occupant of the passenger cabin, a terrified air hostess who was strapped in her seat on the opposite side and farther to the rear of the aircraft. She saw the ball continue to travel down the aisle and finally disappear towards the lavatory at the end. I had no alcohol on this flight.

A very similar account of ball lightning in an aircraft is quoted by Uman³. The ball in this case was larger and of a different colour, possibly as a result of different pressure and slight contamination of the air in the cabin of the aircraft.

Ashby and Whitehead⁴ suggest that ball lightning appears around negatively charged cosmic dust particles of antimatter which descend to ground level. They offer no explanation of the usual suspension of these balls within a few feet of an earthed surface or how the antimatter dust enters an aircraft cabin where it is transformed into a glowing and unerringly moving ball. They do not account for the typical speed of motion or for the shape and size, unless they intended to imply that the size of the ball and its brightness distribution are governed by the mean free path of the ionizing decay fragments. A further problem with this process is that the measurements of cosmic dust in space do not, as yet, indicate that any of the particles are from beyond the solar system, although particles of less than 1 μm diameter with hyperbolic velocities, such as one claimed by Otto Berg⁵, could be expelled by radiation pressure on the fragmentation of larger particles near perihelion⁶. The implication of Ashby and Whitehead's note is therefore that the solar system is well endowed with larger bodies consisting entirely of antimatter.

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After-images and Ball Lightning

ARGYLE¹ has revived suggestions²⁻⁴ that descriptions of ball lightning may simply represent some form of optical illusion. In particular, he postulates that the "bright spheres" are positive after-images caused by observation of short lived effects from nearby lightning strokes. On this view, the apparent movement of a "sphere" is due to the projection of the fixed retinal after-image against different backgrounds, as a result of voluntary or involuntary eye movements.

An obvious difficulty is to account in this way for reports of noise or smell accompanying the disappearance of ball lightning and for occasions when several observers are involved^{5,6}. Argyle suggests that it may be possible to ascribe these and other effects to the peculiar psychological state of people who have narrowly escaped being struck by lightning, and to dismiss those reports where the ball causes damage as "unreliable". But after-images do not remain more or less constant in colour like most lightning balls may change in colour in ways that depend on the initial adaptation of the observer, the primary stimulus and the secondary stimulus or background against which the after-image is viewed⁷. Moreover, an after-image which has disappeared may be recovered by blinking, a change in luminance of the background or by eye movements—an effect not yet reported for ball lightning.

The chief difficulty in the after-image hypothesis is, however, in the reported size of most lightning balls, which are usually said to have a diameter in the range 10–20 cm and to remain constant in size whatever the path followed by a ball^{5,8}. After-images appear to be localized at or in front of the background against which they are viewed, which implies that if the background recedes, the after-image also appears to recede and the observer believes that it has increased in size^{7,9}. On the after-image hypothesis, then, it would be expected that a common feature of all reports would be a direct relationship between apparent diameter and estimated distance. Such a relationship is conspicuously absent in reports of ball lightning.

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Ball Lightning or Spots before the Eyes?

WITH continuing unsatisfactory attempts to give ball lightning a convincing physical basis, it is no surprise that its objective reality has at last been called into question by Argyle¹. Once again physical scientists are asked to adopt the philosophy that if a phenomenon is difficult to explain physically then it cannot be real.

Argyle attempts to explain ball lightning in terms of positive after-images, which have certain properties in common with the former. There seem to be two overriding objections to this conjecture. First, it is hard to understand the unanimity of description in cases where there have been many witnesses, if the explanation is physiological and psychological. The probability that all the passengers of an aircraft will simultaneously experience corresponding positive after-images (which Argyle admits is a rare occurrence) must be very small indeed. Second, with so many more ubiquitous sources of bright lights other than lightning in the environment (the Sun, artificial lights against a dark background and so on) it is hard to understand the association with thunderstorms. Of course, all this presupposes that we ignore the cases involving direct physical effects, which Argyle suggests.