ever O may move in relation to other points of observation, so that the centre of the system of contracting and expanding spheres travels with the observer, and each observer has his own system of spheres. The approaching and contracting spheres contain within them the whole future; the receding and expanding spheres contain the past. The present is the passage of a sphere through O, the observer, when that sphere is concentrated on a point. This conception of a fourth dimension is thus not that of a simple spatial dimension like the other three, but, as required in the theory of relativity, it is intimately associated with time and motion, and the observer's experience of it is simply the happening of events with the flux of time. It is very like the Flatlander's conception of the third dimension derived from the invading sphere. It will be noticed that to different observers the impressions of the present are not quite the same. We observe an event in a star. It is present to us. To an observer in the star it happened years ago.

The theory of relativity involves a change in the unit of time, according to the motion of the observer relative to the object observed. This complication did not enter into the consideration of the space behind the convex mirror, so that the dynamical problems in that space were relatively simple. According to the theory of relativity, if the observer is moving with the velocity of light, time remains unchanged. This must have been the case with the Mad Hatter. With him it was always six o'clock, and always tea-time.

W. G.

Thermionic Valves on Aircraft.

IN a paper just published in the Proceedings of the Royal Society (A, vol. xcvi.) Drs. W. H. Eccles and J. H. Vincent give an account of some experiments on the small variations of wave-length introduced when changes are made either in filament temperature or plate voltage of a thermionic valve supplying oscillating energy to a wireless circuit. It may be of interest to readers of NATURE to know how this effect influenced the design of wireless aircraft generators used in the war.

In 1916, when experimenting with continuous-wave telegraphy and telephony from aircraft, I noticed a small outstanding variation of wave-length radiated from an aeroplane, which variation seemed to depend mainly on the speed of flight, and therefore, possibly, on the voltages supplied by the windmill-driven generator.

Following up this clue, I found in the Air Force Laboratory that the changes of wave-length introduced by variations of filament temperature and plate voltage were more considerable than I had thought, especially on short wave-lengths.

It was the knowledge of this fact which led to the inclusion of special regulating devices in the aircraft dynamo circuits, so that the wave-length variation, at the best of times noticeable owing to aerial sway, banking, etc., should be reduced, at any rate, to a minimum. R. WHIDDINGTON.

The University, Leeds, February 5.

Popular Science.

I SHOULD like to be allowed to underline a few remarks that occur in a review entitled "Scientific Biography" in NATURE for January 29. The writer urges that science has neglected the populace and offered its wares for popular edification in a highly unedifying way. I believe this is very true. I am old enough to remember different times, and can recall with truth and gratitude the feeling of enthusiasm, and even of exaltation, which I had in early days on hearing or reading popular science lectures. I think of Huxley, Tyndall, Clifford, W. B. Carpenter, Lockyer, Roscoe, and some others. Science lectures then were aimed at showing how science did its work, and they brought into view something of the personality of the real scientific worker.

Remembering how much I had gained, I endeavoured in my turn to carry on the good work within the much-restricted range of my own powers, but in the same spirit. In time I realised two things: one, the debilitating tendency of publicity and easily won applause; the other, the invasion of the science platform by the mere entertainer and his *entrepreneur*. The work became suspect to all self-respecting people. The degenerated Press has completed the havoc.

Is it not possible to improve matters? I believe it is. No doubt some knowledge of science is more prevalent than it was, but there is yet ample room for the simple, popular lecture of the genuine kind by men who are the real workers. It is a serious tax, but I am inclined to think a justifiable one, on the time of these men to give, say once a year in some large city, a really popular account of their latest discoveries and have it printed to sell at a popular price. That, and a vocal public opinion in the world of science against comic, pyrotechnic, mystic, or other profane tickling of the groundlings, might do much in a good cause. VICTORIAN.

Mirage Effects.

THE mirage effect noticed by Mr. Quilter and Miss Botley is very common on Woolacombe Sands, especially on hot, sunny days when the observer is looking south. The apparently wet patch keeps at a half to three-quarters of a mile's distance from the eye, but does not persist up to the southern limit of the bay, which is bounded by high ground. I cannot remember whether it is visible when the observer is facing north. SPENCER PICKERING.

MIRAGE effects similar to those referred to in NATURE of January 29 (p. 565) have been noticed by me several times in Birmingham on tarred macadam or wood-block roads. The effect on a hot, sunny day is of a layer of water from 2 in. to 4 in. deep on the surface of the roadway, immersed in which are the feet of pedestrians and the wheels of vehicles about a hundred yards from the observer. The effect is best seen when the line of sight nearly coincides with the surface of the roadway, as, for instance, just before one breasts the summit of a slight rise, when the eye is practically level with the ground beyond the top of the rise. Stooping would produce a similar effect. L. N. NORRIS-ROGERS.

I FIRST saw a mirage on a road in Colombo, and wondered how I was going to cross the apparent sheet of water in front of me. Since then I have seen it repeatedly in England, and instinctively look for it when the conditions are right. For the best effects these conditions are three: (*a*) Tarred roads (the reason is obvious); (*b*) bright sun; and (*c*) a slight gradient rising from the observer.

In very hot weather (*c*) may not be so necessary. At other times the mirage appears where the gradient reaches towards the level of the eyes. It is very clear, and reflections are as sharp as in water, especially of objects crossing near the further edge.

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