in wheat. The change in the 'specific solubility', however, exerts a differential effect since it is just at the extremely low vapour pressure, where the adsorption branch is very flat, that the desorption curve becomes almost vertical. Thus while dry wheat will take up moisture and come very quickly to equilibrium at low humidities, the opposite process of desorption is extremely slow.

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Cosmic Rays and Kinematical Relativity

Milne[1] suggests that the undulatory component of cosmic rays may be the remains of the radiation of very high frequency the existence of which in the remote past I postulated[2] in connexion with the origin of the planets. I do not think that this idea can be accepted without a slight modification which, however, covers the particulate component as well. Consider a photon such as I postulated which had an energy of 6×10^{45} ergs at time $t=2 \times 10^{-63}$ sec. If it reached the earth to-day, then at that time in the past it was in the neighbourhood of a galaxy receding from our own with almost the speed of light. Now, that is to say, with $t = 6 \times 10^{16}$ sec., its energy has been degraded by a factor of 3×10^{-80} by the Doppler effect, and is therefore only 2×10^{-34} erg. This is so even if it has undergone reflexion or refraction. Whereas the energies of cosmic ray photons may exceed an erg ($0{\cdot}6 \times 10^{12}$ electron-volts) and certainly exceed 10^{-6} erg. Moreover, each of the postulated past photons must now be represented by a very large number of photons, perhaps of the order of 10^{40}.

All these difficulties can be overcome if the energy of the cosmic rays has spent a large fraction of the dynamical time since the origin of the solar system not as the electromagnetic energy of radiation, but as the kinetic energy of moving particles, which, according to kinematical relativity, undergoes no degradation like that due to the Doppler effect. During dynamical time τ the energy of a photon relative to matter in its neighbourhood is degraded by a factor $e^{-\tau/t_0}$, where t_0 is about 2×10^9 years. In 3×10^{11} dynamical years most cosmic rays would pass through many galaxies, encountering gas or dust clouds much denser than any matter which may exist between the galaxies, giving opportunities for the transfer of energy between particles of different types, and between particles and photons, and also for the sharing of the energy of one particle or photon among a number of particles. All these events occur in our own atmosphere. Without further data one cannot be precise, but it would seem that most cosmic rays have spent most of dynamical time as particle energy rather than photon energy.

In fact, once the energy spectra of the several cosmic ray components which enter the atmosphere are known, it may be possible to calculate the corresponding spectra at a much earlier date by processes similar to those which are used in calculating the spectra of the 'primary' extra-atmospheric radiation from that at sea-level. If such calculations lead to reasonable consequences, it will be possible to accept the above hypothesis as a provisional account of the history of cosmic rays.

In a recent letter[3] Prof. Dingle suggests that I have been wasting my time in making unverifiable deductions from kinematical relativity. If these deductions are unverifiable I have certainly wasted my time, however true this theory may be. I venture to think that, since the theory which I have briefly adumbrated has fairly wide consequences for stellar evolution, it will be capable, if not of complete verification, at least of observational disproof if it is untrue. If it is so disproved, it may constitute a *reductio ad absurdum* of Milne's theory. In this case I am sure that Prof. Dingle will agree that the time spent in slaying such a Jabberwock has not been wasted.

For I cannot help suspecting that it has survived Prof. Dingle's vorpal blade. He writes that kinematical relativists cannot legitimately explain the Doppler effect by the relative motion of a light source and an observer, since a change of time-scale reduces relative motion to rest, and "we cannot attribute an objective fact to a cause destructible by an arbitrary act on the part of the thinker". This is only true if the arbitrary act does not substitute an equally valid cause (using his terminology, which is perhaps not the best possible in this context). If I break my nose on a lamp-post in the black-out I usually say that it was at rest and I ran into it. If I adopt egocentric co-ordinates I can say that I was at rest and it ran into me. If I use geocentric co-ordinates, I can say that it was moving eastwards at 648 m.p.h. and overtook me since I was only moving eastwards at 645 m.p.h. But all these accounts of the collision lead to the same calculable impulse on my nose. Milne's transformation is a deeper one, since relative motion is not invariant under it. But provided it leads to the same predictions of observable events, as (*pace* Prof. Dingle) it does, it would seem to be scientifically legitimate.

I do not think that it will be rejected on such grounds as Prof. Dingle suggests. But it will certainly be rejected if it consistently leads to false predictions of observable phenomena. At present our most powerful telescopes can only photograph light about 200 million years old, that is to say Permian light. As our backward range in time increases, the divergence between datings on the kinematical and dynamical scales will also increase, and it will become increasingly easy to reject theories which depend on this divergence, should they prove incorrect.

The agreement or disagreement with fact of calculations concerning cosmic rays will also serve as a test of the correctness of Milne's theory.

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