Correspondence

Dust-up in Space

SIR,—Now that an extension of interstellar extinction curves into the vacuum ultraviolet has been made possible by rocket[1] and satellite[2] observations the tendency has been to "duplicate" these curves with increasingly complex mixtures of scattering particles. Claims have been made that a fit between theoretical and observed extinction curve provides justification for a particular grain model. A good case in point is the recent paper "Interstellar Extinction by Graphite, Iron and Silicate Grains" (*Nature*, **227**, 51; 1970). Here, an attempt is made to fit the extinction curve over the wavelength range $0{\cdot}5 \leq \lambda^{-1} \leq 7\mu m^{-1}$ with Mie scattering by a mixture of three types of particle. Such agreement as exists must, for the following reasons, be considered as fortuitous.

(i) The refractive index of the silicate grains is taken to be constant at $m = 1{\cdot}66$ over the entire wavelength range. The refractive index of iron is taken as constant for $\lambda^{-1} > 4$.

(ii) Grains are unlikely to be the perfect spheres assumed. For other than spherical particles, the Mie theory must be modified. A good experimental verification of the importance of grain morphology on extinction has recently been published by Lefevre[3].

In these and other calculations a fundamental point appears to have been missed. This is that the only parameter that characterizes these particles apart from their "radius" is their refractive index and its dependence on wavelength. By using constant refractive indices any working back from an extinction curve to infer the presence of a particular type of material is useless. The refractive index $m = 1{\cdot}66$ no more characterizes "silicates" than it does "hydrocarbons". Surely if one is asked to believe that this result provides any sort of confirmation of the graphite–iron–silicate hypothesis one must demand that the calculations be done with realistic refractive indices.

Perhaps the only feature that does hold some clue to the nature of the material producing this extinction is the hump observed near $\lambda^{-1} = 4{\cdot}6\ \mu m^{-1}$. Here one should remember that although the height of the hump is uncertain and may vary from region to region its wavelength is well established. Despite the fact that Wickramasinghe and Nandy's curves pass through the error bars on the data, their curves clearly peak at $\lambda^{-1} \simeq 4{\cdot}0\ \mu m^{-1}$. Certainly no identifications can be justified on the basis of such a simplified model and such a great mismatch between theory and experiment.

Yours faithfully,

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[1] Stecher, T. P., *Astrophys. J. Lett.*, **157**, 125L (1969).
[2] Code, A. D., *Pub. Astro. Soc. Pacific*, **81**, 475 (1969).
[3] Lefevre, J., *Astron. Astrophys.*, **5**, 37 (1970).

Monsters and Poltergeists

SIR,—I write to comment on your leading article "Monsters and Poltergeists" (*Nature*, **227**, 215; 1970) and to correct what I think are a number of misconceptions contained therein.

First, you stated that "professed belief in the Loch Ness Monster is probably strongest amongst those with stakes in the Scottish tourist trade". It is simply not true that those involved with the tourist trade are the greatest protagonists; anyone at all familar with the Scots (as I think I, as a native, may fairly claim to be) would know that believers and sceptics are evenly distributed in all walks of life. Indeed, the Provost (or perhaps now former Provost) of Inverness, a town which gains a large amount of trade from the publicity of the monster, is one of the leading sceptics.

Second, you imply that the paucity of sightings, as compared with the number of flying saucer reports, is counter-evidence to the monster's existence. I know of no principle of scientific method which states that if a thing is only seldom observed, it does not exist. In any case, it is grossly unfair to compare numbers of sightings in the 25 square miles of Loch Ness with sightings in the whole of North America.

Third, you accuse the Loch Ness investigation of being "no more a scientific endeavour than the hunting of the snark", and you contrast this investigation to the psychic investigators. The difference between their methods is surely one of necessity: the psychic investigators' material can be brought into the laboratory. But the Loch Ness investigation's subject is a lake, and the largest in Britain besides. I defy even the editor of *Nature* to investigate Loch Ness in his laboratory. But because the investigation conducts its research in the field, that is no reason for condemning it as unscientific.

Fourth, you say that "it should not be long before Unidentified Swimming Objects are sighted in the Scottish lochs as regularly as the reports of UFOs in the United States". In reality, one of the most significant facts is that reports of "monsters" do not come from all lochs, but from a few geologically similar lakes in Scotland, Canada and Scandinavia.

Finally, you say that the investigation has not produced "any shred of monster". If by that you mean an actual specimen, that is true. But one does not disbelieve the existence of stars because one has no samples: one believes the photographic evidence for their existence. And in its seven years, the investigation has produced many pieces of photographic evidence for the existence of something inexplicable in Loch Ness.

That "something" may not be a monster, but, contrary to what you suggest in your article, the investigation would be very happy to have what you call "a natural explanation for the sightings" (even though the tourist trade might not). But to deny the evidence, and to sneer as your article does at attempts to investigate it, is reminiscent of the French Academy's eighteenth century scorn of the idea that stones could fall from the sky.

Yours faithfully,

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