LETTERS TO THE EDITOR.

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The Doubly Refracting Structure of Silica Glass.

I HAVE recently observed that "silica glass" possesses a remarkable crystalline or quasi-crystalline structure when examined in the polariscope.

The double refraction is extremely weak, the retardation being probably of the order of 1/10000th of a wave. The structure cannot be advantageously examined with a polarising microscope as used by geologists, for the large number of lenses between the Nicols show enough double refraction to spoil the contrast between the dark and light parts. It is advisable to use a Nicol, and not a glass reflector, as polariser, and to dispense with lenses between the Nicols. A magnifier of 2 in. focus is placed above the analyser. An extremely bright light is necessary; I have used sunlight reflected straight into the apparatus, thus obtaining an intrinsic brightness comparable with that of the sun's disc. (No doubt an arc with a suitable condenser would do equally well.) The Nicols are to be accurately crossed so that the sun is invisible.

If a circular plate of fused silica of "ordinary" quality with polished faces is examined in this arrangement, it shows a striking mosaic of dark and bright parts without regular arrangement. The size of this structure is of the order of half a millimetre. It is seen superposed on the ordinary "dark cross" due to strain, which extends across the whole disc, 6 cm. in diameter.

A rectangular plate of the same class of material showed the dark parts elongated into bands set in a definite direction, and suggestive of a flow structure.

A circular disc of optical quality silica showed a spiral structure.

I have examined a large number of specimens of sheet- and bottle-glass without meeting with any trace of such a structure, which is evidently something quite peculiar to silica glass. It may be suggested tentatively that silica glass consists of a mass of "liquid crystals" comparable with those described by Lehmann in the case of certain organic substances.

It is intended to obtain photographs of these structures, and to study the effect of heat treatment on the silica until it becomes visibly devitrified.

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October 20.

A Search for Fine Wool.

MR. LYDEKKER in his monograph on "Wild Oxen, Sheep, and Goats," published in 1898, stated that the ancestral stock of sheep is not only extinct, "but totally unknown." But in a book on sheep published in 1912 Lydekker admitted that the mouflon and urial had probably contributed to the making of domestic breeds. As a matter of fact, it has been proved beyond doubt (1) that the first domesticated sheep in Europe (*i.e.* the sheep introduced by the Alpine race about 7000 B.C.) were derived from a urial (*Ovis vignei*) not unlike the one now inhabiting the Kapet-Dagh, and (2) that nearly pure descendants of the ancient Neolithic breed still survive on the small uninhabited island of Soay (Sheep Island) near St. Kilda. Further, it is now realised that rams of at least three varieties of *Ovis ammon* have long been used for maintaining the size and vigour of fat-rumped and other breeds of Central Asia. More important still, it has recently been ascertained that the wool forming the inner coat of several of the wild sheep of Asia is longer than in the Soay, and decidedly finer than and quite as white as superfine Australian merino, usually said to be the finest and whitest wool in the world. Crosses between Soay and Southdown sheep yield excellent mutton, and beautiful wool remarkable alike for its strength and quality.

It is hence possible that, with the help of the urial and other wild types, new fine-woolled, vigorous varieties of the merino might be introduced. In the meantime, I am anxious to examine the wool of crosses which include wild species amongst their recent ancestors. Sir Joseph Banks, president of the Royal Society when the attempt was made to establish the merino breed in England, was a keeper of sheep, and was "well informed on all points relating to the production and uses of wool." Some of the readers of NATURE who, like Banks, are interested in sheep may be in a position to help in the new search for the Golden Fleece.

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Radiation Temperatures.

IN a letter to NATURE of October 9 (p. 113) Mr. Mallock points out the uncertainties attaching to records of "temperatures in the sun," due to the influence of the nature of the thermometer bulb on the readings. Similar uncertainties attach to readings of instruments exposed to a clear sky at night, and with even greater force, for there are two main radiation factors here, one of them being the cold ground—such thermometers being generally placed only four inches above the soil—and radiation to the ground is dependent to a very large extent on the nature and condition of the soil, or of the vegetation growing on it. It would appear that the so-called minimum earth radiation temperatures have very little value as meteorological data. Both these and readings of "temperatures in the sun" are affected by a source of error other than that noticed by Mr. Mallock, namely, the size of the thermometer bulb. With very large bulbs this may not obtain, but with bulbs of ordinary dimensions, say from 1·2 to 0·2 c.c., the difference caused by size is very noticeable, and is a curvilinear function of that size; with still smaller bulbs the function becomes rectilinear, the apparent radiation effect varying inversely with the linear dimensions of the bulb. Within the limits of bulb-size above mentioned, the differences observed may be 5 to 10 per cent. of the total radiation effect; and this, with readings "in the sun," might represent differences of 3° to 6° F. These figures apply to mercury thermometers; I have no observations yet with alcohol thermometers.

Differences of radiation temperatures due to the size of the object have an important bearing on subjects other than meteorological records. Thus, it will be impossible to cool a very small object by radiation to a temperature appreciably below that of the surrounding medium; hence the damage done to the pistils and stamens of flowers by frost cannot be due to radiation, but must be the result of the coldness of the air about them; therefore, methods of protection from frost dependent on preventing radiation by interposing a smoke cloud, or smudge, between the tree and the sky, will be ineffective, unless, indeed, the smoke cloud is sufficiently extensive to cover a large tract of country, and thus ensure a material reduction in the loss of heat from the ground by