of 7.6×10^6 deg K, a present core temperature of 2.3×10^8 deg K and an initial one of 5.0×10^8 deg K. The essential conclusion of these calculations is that if neutron stars exist they provide a consistent explanation for the observed X-ray data.

Since the Crab has been associated with the supernova observed by the Chinese in A.D. 1054, a similar ancient event might be expected at the Scorpion position of $\alpha = 16^h 15^m$, $\delta = -15^\circ$. Kepler's nova of 1604 is more than 1 h to the east, far beyond the uncertainty of the location. However, the list of Hsi Tse-tung⁷ includes five events associated with stellar groups surrounding the Scorpion position. The Chinese recorded new stars near β , δ , π , or ρ Scorpii in 134 B.C., A.D. 436, and A.D. 1584, while another was noted by the Japanese east of ϕ , χ , ψ , and ω Ophiuchi in A.D. 891. Some of these may have been comets or ordinary novae. The most intriguing reference is one by Humboldt⁸ stating that around A.D. 827 the Arab astronomers Haly and Giafar Ben Mohammed Albumazar at Babylon saw a new star in Scorpion which was as bright as the quarter moon and was visible for 4 months. This is an interesting event even if further investigation of Arabic records shows that it occurred in a different part of Scorpion.

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PHYSICS

Thermal Diffusivity of Non-metallic Materials

To minimize the propagation of the effects of an abrupt change in temperature, an insulating material is required with a low thermal diffusivity. This property is proportional to the thermal conductivity and inversely proportional to the density and the specific heat, but because of the comparative invariance of the latter property among typical insulating materials, the diffusivity is almost proportional to the ratio of conductivity to density. Although the conductivity of non-metallic materials decreases generally as the gross density decreases, their ratio, and hence the diffusivity, is found to pass through a

Fig. 1. Thermal diffusivity of non-metallic materials

minimum, so that materials with the lowest conductivities do not necessarily have low diffusivities.

When an examination was made of published experimental results¹⁻⁵ on the diffusivity at room temperatures of material which might be used for insulation, it was found, as shown in Fig. 1, that the minimum occurs with materials having gross densities of about 1 g/cm³. A wide scatter is to be expected from such a diversity of materials, ranging from expanded plastics, corks and timbers, through various plastics and rubbers to concretes and bricks, but the minimum is fairly well defined. In such complex materials, the thermal properties depend so much on the structure that it seems unlikely that any particular physical significance can be attached to the existence of a minimum thermal diffusivity, though attention does not seem to have been directed to it hitherto.

In practice, the choice of a material to isolate temperature transients often depends on other factors such as thermal stability. Where the temperatures are not high enough to restrict the choice, however, it is indicated that the promising materials are those with specific gravities around unity, which are often thermoplastics such as polystyrene. With these materials the thermal diffusivity may be as low as 10^{-3} cm²/sec.

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Influence of Electrode Coatings on Space Charge Distributions in Transformer Oil

WHEN a static electric field is applied to a liquid insulant contained between two electrodes, an accumulation of charge carriers takes place at the electrode-liquid boundaries. The transient disturbances which occur during conduction current measurements, following the sudden application, removal or alteration of the applied voltage, are indicative of such space charge formation. It has recently been shown also that the build-up of space charges by static prestressing can significantly affect the pulse breakdown strength of a liquid dielectric¹. The presence of space charges in an insulating gap produces a non-uniform distribution of voltage within that gap; a knowledge of this distribution and how it is affected by conditions at the electrode surfaces should contribute to a better understanding of the conduction and breakdown mechanisms in liquid dielectrics.

The present work forms a sequel to that reported in an earlier communication on the influence of electrode coatings on conduction currents in transformer oil² and gives the results of the steady-state potential distributions between electrodes in filtered transformer oil. Both the coated and uncoated electrodes were of brass polished to a 0.25 μ diamond paste finish. These had a uniform field profile and a nominal diameter of 2.5 cm. The coatings on the electrodes consisted of a pore-free film of the thermoplastic, 'Penton', 0.25 mm thick. The voltage distribution between the electrodes was determined using a travelling probe in conjunction with a galvanometer type electrostatic voltmeter. The nichrome probe wire, diameter 0.2 mm, was sheathed in glass, except for a length of 1.5 mm at the end which was exposed to the oil in the uniform field region of the gap. With the direct