

fact that most of the ionization was situated within the ozonosphere, as is certainly the observed absence of magnetic effects of the ionization.

BENGT HULTQVIST
JOHANNES ORTNER

Kiruna Geophysical Observatory,
Kiruna C, Sweden.
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Radio Reflexions from the Moon and Solar Corona

THE ionospheric Faraday effect has recently been used^{1,2} to determine the total electron content of the ionosphere. The rotation of the plane of polarization is assumed to be given by:

$$\varphi = 4.72 \times 10^4 f^{-2} B \cos\theta \sec\delta \int_{H_1}^{H_2} N dh \quad (1)$$

where the limits of integration correspond to the ionospheric region in which the electron density is large enough to make an appreciable contribution to the rotation (for notation see ref. 2).

On the other hand, the theory of 'whistlers', investigations on the solar corona³ and also the researches on the first Russian satellite⁴ have led to the assumption that there are some hundred electrons per c.c. in the space around the Earth. This necessitates modification of formula (1). If we assume a constant electron density N_0 along the path from the outer ionosphere ($r = r_E + H_2$) to the Moon ($r = r_M$) we have:

$$\varphi = 4.72 \times 10^4 f^{-2} \left\{ B \cos\theta \sec\delta \int_{H_1}^{H_2} N dh + N_0 \int_{r_E + H_2}^{r_M} \cos\theta dr \right\} \quad (2)$$

or, to a good approximation:

$$\varphi = 4.72 \times 10^4 f^{-2} B \cos\theta \left\{ \sec\delta \int_{H_1}^{H_2} N dh + \frac{1}{2} N_0 (r_E + H_2) \right\} \quad (3)$$

With $(r_E + H_2) = 7.4 \times 10^8$ cm. and $N_0 = 10^3$ cm.⁻³, we get 3.7×10^{11} cm.⁻² for the second term, while $\int_{H_1}^{H_2} N dh$ is about 100×10^{11} cm.⁻². Hence we can estimate that in many cases the error introduced by neglecting this second term will not be important, and that, for example, the results obtained on the new F -layer model⁵ will not be influenced strongly. But at times of small solar activity, the electron density in the ionosphere will decrease considerably and then we cannot neglect the electrons in the space around the Earth. In these and some other cases (for

example, in the polar regions) we must take the revised formula (2) into consideration.

O. BURKARD

Institut für Meteorologie und Geophysik,
University, Graz.
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Nature of Fluorescence of Uranium in Fused Sodium Fluoride

ALTHOUGH the property of fluorescence of uranium in sodium fluoride melts has been used to determine uranium quantitatively for the past 25 years, it is not known in what form the uranium exists in these melts. It has been the belief that the fluorescence in fused salts is due to a uranyl compound, but the evidence is not conclusive^{1,2}. The intensity of fluorescence of the melts is so sensitive to slight variations in the fusion process that it is necessary to standardize all manipulations to obtain reproducibility. The cause of this sensitivity has not been explained. In an attempt to explain it several different uranium compounds were fused in different atmospheres. The intensities of fluorescence of the melts as well as fluorescence and absorption spectra were measured.

All the uranium compounds used for the experiments were made in this Laboratory. A sample of uranium tetrafluoride was also obtained from Harwell. A very high standard of purity is required as many impurities quench the uranium fluorescence. The sodium fluoride used was 'Baker analysed' and was specially prepared for use on the fluorimeter. This brand of flux was found to be entirely free of sodium carbonate, which is useful at times but not essential, as sodium fluoride-sodium carbonate flux mixtures are often used. Sodium fluoride decomposes during fusion to form small quantities of sodium carbonate when moisture and carbon dioxide are present in the atmosphere³.

UO_3 , U_3O_8 , UO_2 , UF_4 and $UO_2(NO_3)_2$ were fused with sodium fluoride in air at $1,160^\circ$ C. and all melts fluoresced strongly. The high fluorescence of UF_4 was unexpected since uranium (IV) compounds have not been known to fluoresce. A test was devised to determine the valency of the uranium in the melt, using the property that cupferron precipitates uranium (IV) but not uranium (VI) in 10 per cent sulphuric acid solution.

Two separate portions of a solution containing uranium (IV) in 10 per cent sulphuric acid were treated with cupferron. Sodium fluoride had first been added to one portion, when a powdery green precipitate had formed. No further precipitation occurred on the addition of cupferron. The uranium (IV) in the second portion was immediately precipitated by cupferron. The sodium fluoride thus reacts with uranium (IV) probably forming a double fluoride, namely, $NaUF_6$, as reported by Katz and Rabinowitch². This compound was found to be non-fluorescent.

This test was repeated using a melt in which uranium tetrafluoride had been fused in air with a low-melting mixture of sodium fluoride and sodium