$$\Delta_4 E = -\frac{8}{hcR^5}\sum_{l,m} q_l^2 q_m^2 \int_0^\infty \frac{u_l u_m}{(u_l^2+y^2)(u_m^2+y^2)} (y^4+2y^3+5y^2+6y+3)e^{-2y}dy. \quad (3)$$

Each term of the summation in (3) converges to the corresponding term in (2), if:

$$R \ll \lambda_l = \frac{hc}{E_l} \text{ and } R \ll \lambda_m;$$

and therefore the London energy is proportional to R^{-6} if R is very small. In the case $R \gg \lambda_l$ and $R \gg \lambda_m$ the term in (3) is proportional to R^{-7} rather than to R^{-6}.

A simple illustration of essentially the same mechanism is obtained by studying the image force between one neutral atom and a perfectly conducting plane. In this case, the interaction energy is found to decrease as R^{-4} at large distances and as R^{-3} for $R \ll \lambda_l$.

Details of the quantum mechanical calculation and of the application of our results to the problems of colloid chemistry will be published in *Physica*.

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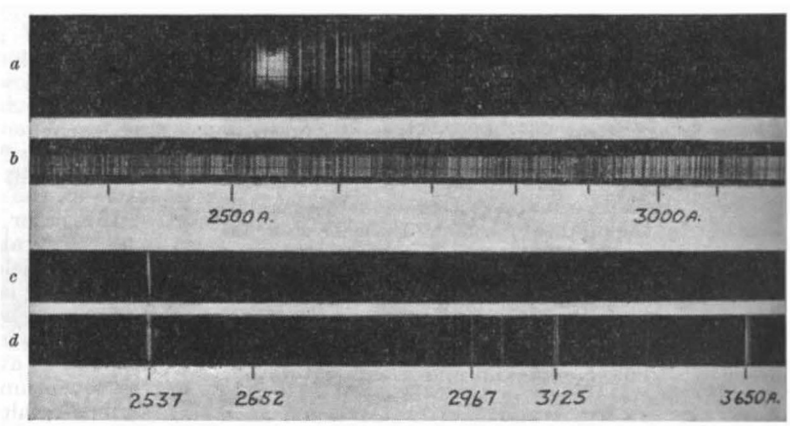
A Christiansen Filter for the Ultra-violet

THE type of colour filter developed by Christiansen[1] consists of a powdered transparent solid (for example, glass) immersed in a liquid of about the same refractive index but with a different dispersion. For one particular wave-length the refractive index of the liquid and solid will be exactly the same, and this wave-length will be transmitted, while other wave-lengths for which the refractive indices are not quite the same will be scattered by the powder and so not transmitted. The theory of these filters has been discussed by Sethi[2], and Kohn and Fragstein[3] used a filter of amorphous silica in a mixture of 56 per cent benzene with 44 per cent ethanol to isolate the Hg line 3650 A. There does not appear to be any record of work farther in the ultra-violet, and it seems desirable briefly to report our attempts to develop a filter to transmit the 2537 A. line of Hg. This was required for quantitative measurements on the absorption of hydrogen peroxide produced during certain combustion processes.

Beyond 3000 A., the choice of suitable transparent solids and liquids is very limited. Attempts to make a filter using crushed fused quartz and mixtures of either chloroform, carbon tetrachloride, *n*-hexane, cyclohexane, or ethanol, were not very successful because the difference in the dispersions of the liquid and solid was insufficient. We obtained sufficient success, however, using crushed fluorite (CaF_2) in a mixture of carbon tetrachloride and ethanol. For 2537 A. we found that a cell (of fused quartz) about 0·75 cm. thick, packed with fluorite which had been sieved through a 60–120 mesh, and filled with a mixture of 43 per cent carbon tetrachloride with 57 per cent ethanol, was most satisfactory. The cell was heated in a water-bath at 18·6° ± 0·05° C.; a change of 1° C. altered the wave-length of maximum transmission about 10 A.

The cells were examined with an iron arc and a medium-size quartz spectrograph. To obtain good results it was essential to use the cell in accurately parallel light and not to place it too close to the slit. The testing set-up consisted of the arc, a quartz lens to render the light parallel, the cell, and a second lens to form an image of the arc on the slit; the lenses were focused for the ultra-violet. With this set-up the rays at the optimum wave-length formed a sharp image on the slit and gave a narrow spectrum in this region; wave-lengths slightly greater and less than the optimum gave a less well-defined image on the slit and hence a wider, less intense spectrum. The spectrum thus showed a cusp-shaped patch of light, as indicated in Fig. *a*, which may be compared with the normal arc spectrum without filter (Fig. *b*).

The filter gave a little scattered light of other wave-lengths, but the bulk of the transmission was limited to a narrow region about 50 A. broad. The transmission at the optimum wave-length was only about 1–2 per cent, but the filter did nevertheless isolate the Hg 2537 line fairly well, and it served our purpose satisfactorily. Figs. (*c*) and (*d*) show the spectrum of a quartz mercury discharge tube with and without the filter. With the mercury discharge tube no appreciable photochemical decomposition of carbon tetrachloride was detected, but with an iron arc some trouble was experienced, and it was necessary to protect the filter with another cell containing a thin layer of carbon tetrachloride which could be changed frequently. The tetrachloride used in the filter had to be carefully purified from unsaturated compounds which absorbed the near ultra-violet.



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