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Nobel Prize in Physics 1908

Gabriel Lippmann

The Nobel Prize in Physics 1908 was awarded to Gabriel Lippmann *"for his method of reproducing colours photographically based on the phenomenon of interference"*.

RESEARCH INFORMATION:

The Royal Academy of Sciences has awarded the Nobel Prize for Physics for 1908 to Professor Gabriel Lippmann of the Sorbonne for his method, based on the phenomenon of interference, which permits the reproduction of colours by photography.

Even before 1849, when the art of photographic reproduction was discovered by the pioneers of Science, Niepce, Daguerre, Talbot and others, the question of means of rendering and of fixing colours on the photographic plate has loomed large. It looked as though the answer was at hand when Edmond Becquerel showed that a silver plate coated with a thin layer of silver chloride coloured up under the action of light with a colour corresponding to that of the light used. This observation led no further. Becquerel had no explanation for the origin of the colours nor did he find a means of fixing them on the plate. They passed off rapidly and so his method, being thus of no practical use, failed to win the attention it undoubtedly deserved.

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One explanation for the origin of Becquerel's coloured images was given in 1868 by the German Wilhelm Zenker and then taken further by the Nobel Prize winner Lord Rayleigh. According to this explanation, the colour phenomenon is due to standing light waves that by chemical action form grains of silver metal from the silver chloride. Colour is an interferential phenomenon produced by the reflection of light on this silver layer.

The phenomenon thus became of theoretical interest. If the truth of this theory could be shown, the work of Becquerel would afford further proof of the correctness of our concept of light considered as the result of vibratory movement, since one of the fundamental phenomena of vibratory movement - the standing wave - would thus be verified for light. It was, however, not until 1890 that Otto Wiener by a particularly fine experiment furnished conclusive evidence of the correctness of Zenker's theory.

It was now possible to reproduce pictures in more or less exact colours but still not stable. Explanation had also been found for the origin of these pictures. It was still not time to talk of photographic reproduction of the colour of objects and their *fixation*. This was the point reached when Professor Lippmann in 1891 communicated to the Paris Academy of Sciences his sensational work *Colour Photography*.

The main features of the Lippmann method are doubtless fairly well known. On plane glass a layer sensitive to light is spread, consisting of gelatine emulsion, silver nitrate, and potassium bromide. To this sensitive layer a layer of mercury is applied, forming a mirror. This is exposed in the dark room in such a way that the glass side of the plate is turned towards the objective. During exposure light has to pass through the glass first, then penetrate the imprint layer and encounter the reflecting surface of the mercury, which throws it back. These incident and reflected light waves form what are called standing waves, characterized by a series of maxima and minima of illumination, distant from each other by half a wavelength of the incident light. Once the plate is developed, fixed, and dried by normal processes, there will be found in the layer of gelatine planes of reduced silver whose reciprocal distances depend on the wavelength - that is to say, on the colour of the light which produced the image. Let us suppose that white light falls in the normal way on a photographic plate disposed as we have described. The ray will be reflected by the different planes of silver and, following known laws of interference of light in thin laminae, the foil will appear coloured - and coloured with the same colour as the light that gave rise to the corresponding photographic print. The reproduction of colours is thus being carried out hereby the same way as in soap bubbles and thin laminae in general, with additional strengthening by the existence of successive planes. The effect of colour in Lippmann's experiments does not therefore arise from pigment colours. We have to do with what are called virtual colours, unalterable in composition and bright for as long as the photographic plate is intact. Thus Lippmann's photographs show up favourably in comparison with later attempts at solving this problem of colour reproduction - Lumière's photographs - so-called three-colour photographs, obtained by using pigment colours, a delightful discovery, which owing to the simplicity of the operational method has rightly won a large measure of popularity.

One glance at the illustrated works of our day, both in the domain of science and of art and industry, is enough to show the key position of photographic reproduction in present-day life. Lippmann's colour photography marks a further step forward, which is of great importance, in the art of photography, since his method has been the first to give us the means of presenting to posterity in unalterable picture form not only the shape of an object with its play of light and shade but its colours as well.

Through sustained effort directed towards his end and through his complete grasp of all the resources that physics can offer, Professor Lippmann has created this elegant method of obtaining images which combine stability with colorific splendour. This achievement the Royal Academy of Sciences has considered worthy of the award of the Nobel Prize for Physics for 1908.

For more details please visit:

http://www.nobelprize.org/nobel_prizes/physics/laureates/1908/press.html