who above all believed in experimental facts and was very careful concerning the explanations deduced from the experimental facts. He interpreted the experimental facts as simply as possible and advised his co-workers to act in a similar manner. In the case of a collaborator reporting on some partial result in the course of the experiments, he listened to him readily and even talked the matter over with him in detail, but if by any chance something diverging from the simple experimental facts was mentioned for instance: I believe this phenomenon will result in, then the answer was always: „it must be examined."

A significant part of his work was devoted to education. His lectures were exemplary, lucid and very comprehensible. He also directed his attention towards eliminating the dryness and monotony of the lectures by illustrating them with observations and ancdotes. He educated a whole generation who were all very attached to him and deeply moved by the event of his death.

His deeply human feelings and trend of thought was shown by the fact that he provided with equal kindness for all the members of his institute. He considered everybody to be his friend and as such tried to support them in every possible manner.

He died on October 15, 1949 quite suddenly under tragic circumstances. Unfortunately we could no more celebrate his 25 years jubilee as a Professor. Even during his brief illness — when he felt a little better — he sent for his co-workers and attempted till the very last to support them with his advice.

His death is an irreparable loss to his friends, co-workers, pupils and the University of Szeged.

The Scientific Research Work of P. Frőhlich

He began his scientific investigations with examinations concerning the field of classical optics. His earliest investigations were concerned with the examination of the polarization of the refracted ray in the vicinity of the critical angle of total reflection (1, 2). He examined the polarization state of refracted light rays at the critical angle of the total reflection. If the incident light ray is perpendicularly polarized to the plane of the incidence, i. e. the vector lies in the plane of the incidence, then a linear vector penetrates into the second medium which changes towards the direction of the normal of the separating plane.

The examinations strictly proved the theoretically established behaviour concerning the polarization of the refracted light ray.

He dealt in several papers in detail with one of the most important laws of classical optics with the limit of the validity of the geometrical law of reflection (3—7). In classical optics it has been theoretically established that the light vector penetrates also in the case of total reflection into the second medium. With the depth of the penetration the amplitude of the vector diminishes. Thus complete refraction can only occur if the thickness of the less dense medium is greater than the depth of the penetration of the vector. The experimental decision of the question is very difficult. Paul Fröhlich attempted to approach the problem from another point of view. The theory also leads to the conclusion that if the distance of the source of the light is the order of magnitude of the length of the light waves from the surface, the geometrical law of refraction is not valid.

This question was examined by P. Fröhlich. He elaborated an experimental method which enables the quantitative establishment of the deviation. Numerous detailed very accurate measurements were accomplished finally proving the expected results.

These earlier optical examinations concerned the completion of the knowledge of the most fundamental questions such as: the total reflection and the refractivity of light and achieved vital results.

In the middle of the third decade of this century Paul Fröhlich directed his attention towards the study of a very important branch of physics. He began to investigate structural problems by a significant method of investigation dealing with fluorescence and phosphorescence. This group of phenomena leadl to very interesting and significant results, e. g. the conception that the emission of light is related to the return of the electrons to their original orbit in the atom was suggested for the first time in this connexion. P. Fröhlich continued his investigations in respect to luminescence without interruption till his death attaining very significant results in these studies which were also acknowledged by other investigators and also opened up new lines of approach for further research work. This paper can only give a very brief outline of his studies.

His examinations dealt with a characteristic group of the organic dye-phosphores with the gelatine phosphores. In the case of gelatine-phosphores the organic dye is firmly embedded in a rigid gelatine layer (10) and on excitation it fluorescences brightly giving with the Becquerel phosphoroscope a well visible phosphorescence.

The examinations concerning emission and absorption as well as excitation, decay etc. yielded many important results. According to Pringsheim and Vavilov the phosphorescence band is found always towards the long waves, consequently, particularly at low temperature, after the ceasing of the excitation a colour change in the long waves always takes place. Paul Fröhlich has shown (11, 12) that a colour change in the short waves can also occur and what is more, at certain temperatures, in particular cases, even a double colour change may take place.

Thus it could be proved that at certain temperatures the phosphor has two phosphorescence bands of different decay periods, one of which is found towards the short waves and the other towards the long ones, as compared with the fluorescence band. In connexion with this subject detailed examinations were carried out to elucidate the dependence of the phosphorescence band upon the temperature. (14, 15). It was demonstrated that the phosphorescence bands do not only depend in respect to their intensity, but also regarding their spectral distribution upon the temperature.

From the point of view of the dependence on the temperature certain temperature optima occurred which varied entirely at the different bands of the same phosphor. The correlation between the individual bands and the optimal temperature, furthermore the relation to the concentration of the dye were determined by the analysis of the bands. Thus he established the importance of the concentration and temperature as regards the emission. He established which law governed the changes of the optimal temperatures and concentrations relating to the whole band complex of the phosphorescence.

In the course of their studies concerning emission Paul Fröhlich and Z. Gyulai (13) also discovered the phenomenon of the preexcitation effect, i. e. that the intensity of the emission is greater if the preparation is preexcited. At the subsequent examinations this phenomenon proved to be of great significance leading to highly interesting new establishments which will be described later.

Among the examinations relating to luminescence, the investigations dealing with the polarization of the emission are the most outstanding. On submitting the methods employed for the measuring of partial polarization to a critical survey a photoelectric method was worked out with the aid of which it succeeded for the first time to demonsrate that contrary to earlier conceptions the phosphorescence band is partially polarized pointing to the fact that the emission of its fluorescence, as well as its phosphorescence band, is a consequence of a unitary molecular mechanism. Within the emitting molecule the electron is anizotropic in respect to one axis also performing at room temperature thermal rotation. (10). In examinations carried out with liquid solutions he determined through the extent of the polarization of the fluorescence emission the dependence of the liquid upon the viscosity. He showed that in the case of different solvents with an identical viscosity the angle of polarization varies, hence a specific solvent effect can be established (8, 9). If the wave lengths of the exciting light increase, the angle of the partial polarization increases too. Examinations dealing with the phosphorescence emisson of solid gelatinous solutions of various dyestuffs led to the discovery of negative polarized emission (16, 17). It could be established that the angle of polarization could only be negative if the solid solution was cooled under a critical temperature, as otherwise in the temperature range characterizing negative polarization the range of polarization is a constant zero. The results obtained concerning polarization are in accordance with the theories of Perrin and Jablonski even supplementing them to a certain extent. It had to be assumed that with the changing of the temperature the angle made by the absorption and emission oscillator also changes and the smaller this change the more stable the structure.

The investigation of the partial polarization of the emission, as well as that of other questions relating to emission have led to the discovery that freezing and heating exert an influence on the structure of the preparation, however, the caused changes vary to a great extent. After heating, the preparation does not regain its original properties, whereas after freezing it usually behaves in the same manner as previously. It may be that the water which is removed under heating is the cause of this difference.

All studies have revealed that the manner in which the preparation is produced influences the properties of the solution to a great extent. In earlier investigations therefore, great care was taken that the method of preparation should be identical. Recently absorption measurements have enabled the determination of the factors influencing decisively the properties of the preparation in the course of the production. Thus it could be established that in relation to the absorption the initial concentration is the only essential factor, i.e. the concentration of the aqueous solution used for the preparation of the gelatine solution. This proved that an associated state exists also in solid solutions and that the ions participating in the absorption proceed unchanged from a liquid solution into a solid one, without being influenced by gelatine (21). Later it was shown that in the course of drying the associated state can slightly change, particularly if that process covers a longer period.

The analysis of the emission bands is rendered difficult owing to the phenomenon of self absorption, caused by the fact that the emission and absorption band intersect. The changes brought about by self absorption can be taken into account on the base of theoretical considerations. The equation obtained by virtue of theoretical calculations is in complete agreement with the experimental results (23).

The behaviour of dyestuff solutions was also investigated in an electric and magnetic field, however, a constant magnetic field did not cause an appreciable effect. A rotating magnetic field on the other hand, produces a constant change in the molecules of dyestuffs. This change could also be demonstrated with absorption measurements: in some cases a splitting of the band, in others a shift could be observed, detailed investigations concerning this matter are still in progress (20).

The further examination of the preexcitation effect described above led to the discovery of the quenching effect of preexcitation. Hence radiation with intensive light may not only effect an increase in absorption, but also its decrease. Recently both effects could be interpreted by virtue of a unitary molecular mechanism.

On the base of the theory of oriented light absorption the positive as well as the negative preexcitation effect can be explained. As in the same molecule a change of temperature may cause a positive preexcitation effect to change into a negative one, presumably in the same molecule the experimental conditions are the decisive factors determining whether normal or abnormal orientation is prevaling. This is a quite new result which has also been proved recently by another method (19, 22).

In order to afford a complete survey of the scientific research work of P. Frőhlich the results which have been enumerated in outline ought still to be supplemented with the results achieved by his collaborators and pupils as, of course, he promoted their investigations with his advice also giving them many new ideas.

Naturally these results cannot even be sketched in the frame of this paper. The investigations of P. Frőhlich, as well as those of his co-workers and pupils involved very extensive experimental material relating to the process of luminescence leading to better understanding of this process. They contribute many significant factors to the progressive elucidation of the correlation existing between the different phenomena which could previously not be interpreted unitarily.

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