optical instruments employing polarized light at high angles of incidence[2] without due consideration of the image quality. On the other hand, some of the properties described may be used to advantage for modifying the aperture function and even for obtaining higher 'resolution' in special cases. In general, the Rayleigh criterion of resolving power is not applicable and, instead, it is suggested that the transfer (or response) function of the system be used to evaluate the image.

The diffraction anomalies and the resulting spurious image are practically eliminated with the polarization rectifier[3]. The rectifier corrects the rotation so that the state of polarization is no longer irregular, and a uniformly dark aperture is obtained. Fig. 4 shows the correct image of the same test-chart viewed through a pair of rectified oil-immersion objectives. With rectification, the maximum resolving power of the light microscope can be realized, and the system has been utilized for exact studies of biological objects possessing birefringence down to a fraction of an angstrom unit.

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Mosaic Structure of Photographic Emulsion Crystals

Crystal imperfections play an important part in present studies of the formation of the photographic latent image. In large silver bromide crystals it has been shown[1] that silver prints out along individual dislocation lines. Little direct evidence has yet been given on defects within the small grains of photographic emulsions, since neither light microscopy nor electron microscopy has yet proved effective in this field.

It was found by a convergent beam X-ray analysis[2] and by an X-ray microbeam diffraction method[3] that there exist in the grains of some commercial photographic emulsions distinct angular misalignments and sub-structures. In recent studies of X-ray microbeam transmission photographs using a Hilger 'Microfocus Unit' we have now been able to obtain separately resolved structures within the diffraction spots from individual emulsion grains. In some of these spots up to six individual subdivisions can be detected (see Fig. 1*a* and *b*, each of which shows enlargements (×120) of a diffraction spot). Such high-resolution spots were obtained with X-ray tube focal areas of dimensions 4 × 40μ and 100 × 140μ with lead glass capillaries of 10μ diameter as collimators for the incident X-ray beam. As recording

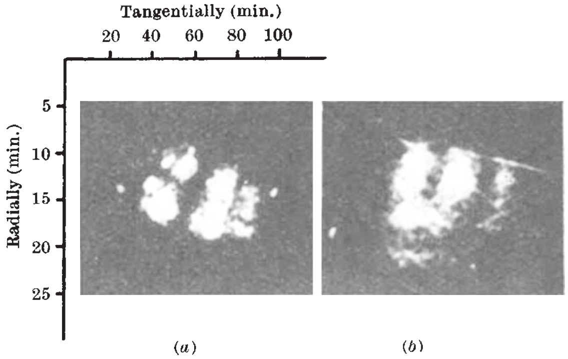

Fig. 1. Enlargements (× 120) of diffraction spots taken from a photographic emulsion having grains with a mean diameter of 1μ (*a*) and 1·5μ (*b*). Each group of spots corresponds to a diffraction image of one grain. The scales correspond to the angular displacement of planes in radial and tangential directions

material Kodak 'Crystallex' X-ray film was used. Experiments were carried out to show that the grains themselves, and neither the intensity distribution of the focal spot nor the structure of the paper of the envelope of the recording film, is responsible for the effect. This evidence is also supported by the fact that within the same type of photographic emulsion grains different types of characteristic structures of spots can be distinguished within the spotty powder ring. On the other hand, certain other emulsion grains under the same exposure conditions show diffuse diffraction spots (without any sub-divisions) and this effect is probably due to broadening of small crystallites size. (*Note added in proof:* We now have direct evidence that this explanation is correct.)

From considerations of the divergence of the X-ray beam, the natural spread of wave-lengths, and the separation of the $K\alpha_1$ and $K\alpha_2$ wave-lengths, it is concluded that the detail within diffraction spots reveals the mosaic structure of the grains. From measurements of the distances between nearest structure elements within diffraction spots it is found that angular misalignments of 3′–4′ between planes are resolved.

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Neutron–Proton Interaction

The present communication suggests a new approach to the proton–neutron interaction and the deuteron problem. We have been able to calculate successfully the binding energy of the deuteron by the suggested interaction. The approach is phenomenological in that the structure of the nucleons has not been taken into account.

It is proposed that the interaction between the nucleons is magnetic. First let us consider a model based on the old quantum theory. Let μ_p and μ_n represent the magnetic moments of the proton (positive) and neutron (negative) respectively, and let r be the distance between them. Then the