The study on the diffraction field distribution by photomultiplier

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The diffractive field distributions of the dark edge on the negative, the edge of the knife and the single edge of the wire were investigated using photo-multiplier system. The results show that the new diffractive formula with the parameters describing the property of the edge of the diffractive object should be established and that the property of the object may be realized by the investigation of the weak diffractive field distribution of the object.

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The diffractive field distributions in the area of the classical optics are often described by the Fresnel-Kirchhoff diffraction formula[1,2]. The results obtained in terms of the Fresnel-Kirchhoff diffraction formula are in agreement with the experimental data detected by the conventional detector. However, there are not the parameters describing the property of the edge except for the one describing the shape of the edge of the diffractive object in the Fresnel-Kirchhoff diffraction formula and it seemed that the diffractive field distribution is not relevant to the property of the object. Here we studied the diffractive field distributions of the dark edge on the negative, the edge of the knife and the single edge of the wire by photo-multiplier system but not by the conventional detector.

The experimental setup is shown in Fig. 1. In the process of the study of the diffractive field distribution by photo-multiplier system, a lot of the problems are solved, including adjusting the optical way, eliminating the background light, attenuating the energy received by the detector, and so on. What's more, the laser is warmed up for half an hour before we do the experiment, and we record the data from one side of the transverse field to the other and placed the attenuator in the certain place in order to secure the devices not to be burned. In addition, we record the mean values of the three consecutive data as the experimental data in the every place and the experimental data are by the attenuating factor so that the experimental curves are in agreement with the diffractive field distributions.

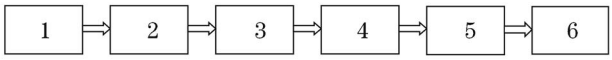

Fig. 1. The experimental setup. 1: laser; 2: devices those eliminated the background light; 3: sample; 4: attenuator; 5: photomultiplier system; and 6: digital counter.

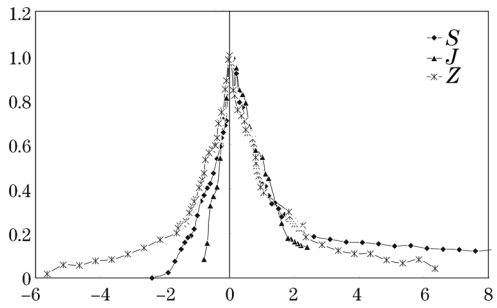

Fig. 2. The light intensities experimental curves of the diffractive fields of the knife edge (Z), the film edge (J), and the wire (S).

On the base of the above operating, the diffractive field intensity distributions of the dark edge on the negative, the edge of the knife and the single edge of the wire are studied and the experimental curves are shown in Fig. 2.

The above curves of the diffractive field distributions show that the three curves are the same in one certain zone. In the certain zone, the diffractive field intensities are strong and can be detected by the conventional detector, and the diffractive field distributions can be described by Fresnel-Kirchhoff diffraction formula. Here we named the certain zone as the custom diffractive zone. Beyond the custom diffractive zone the curves of the diffractive field distributions are different due to the differences of the property of the diffractive object. The investigations show that the property of the object may be realized by the investigation of the diffractive field distribution of the object and that only the new diffractive formula with the parameters describing the property of the diffractive object can potentially describe the whole diffractive field.

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