(1962), Soviet Phys. JETP **16**, 1459 (1963); Paper presented at the Ninth All-Union Conference on Low-Temperature Physics, Leningrad, June, 1962.

[13] M. S. Khaĭkin, PTÉ No. 3, 95 (1961).

[14] R. T. Mina, JETP **40**, 1293 (1961), Soviet Phys. JETP **13**, 911 (1961).

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THE USE OF A LASER IN THE INVESTIGATION OF THE COMBINATION SCATTERING SPECTRA OF COLORED POWDERS

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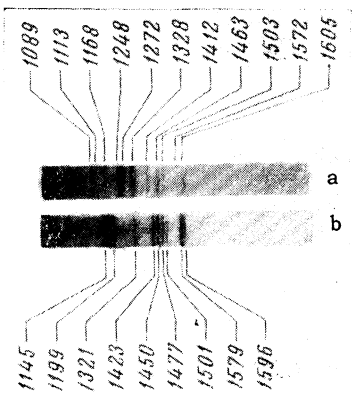
THE spectral investigation of combination scattering of powders is fraught with remarkable difficulties associated with the small effective transparency of the object, the large scattering of the exciting light, etc. In the case of colored powders these difficulties are aggravated since the characteristic absorption of the object does not allow examination in the commonly used spectral region (4000—5000 Å). In this case it would be advantageous to carry out investigation in the yellow and red spectral regions. Existing sources for the excitation of combination scattering in the long wavelength region (helium, cadmium lamps, etc.) are not completely satisfactory since either they do not have sufficient intensity or interfering lines and a certain continuous background are present in the spectrum.

The advent in recent times of new sources of monochromatic radiation—lasers in the optical region—is of unusual importance for the present problem. The advantages of this source for the excitation of combination scattering spectra (the presence of a single narrow line and high power) have been discussed in the literature many times, but there has been only one paper on its experimental realization.[1]

A ruby laser, which gives a line at 6943 Å, i.e., in the red, is by far the most suitable one for our problem.

For our investigation we used a grating spectrograph having 600 lines/mm with the ruled part 140 × 150 mm in extent. Identical, f 1, 250 mm objectives were used in the collimator and the camera. The work was carried out in the first order at a dispersion of 62 Å/mm. Infra-760 plates and Infrarapid-750 film were used to record the spectra. In photographing the spectra of the powders we used the simplest method—exposure "by transmission." A cuvette containing the substance under investigation was placed directly before the slit of the apparatus. The exciting light was focused on the samples by means of a condensing lens. This arrangement allowed the most complete use to be made of the large aperture of the instrument, since the light passing through the powder is in a very large solid angle.

A ruby laser operating at low power was used as the source. The energy in the flash from the pumping lamp varied between 1.0 and 1.8 kJ. The crystal was cooled in a stream of vapors from liquid nitrogen. In order to eliminate parasitic light the source was placed at a distance of 2 m from the cuvette containing the sample. From 30 to 100 flashes were needed to obtain a recording of the spectra, using a slit width of 0.07—0.1 mm, which in this region is equivalent to 8—12 cm^{-1}.



Combination scattering spectra obtained by excitation with a ruby laser; a – 4,4'-azoxyanisole; b – anisal-para-amino-azobenzene.

The combination scattering spectra of a number of powders were obtained. By way of illustration we show the spectra of 4,4'-azoxyanisole, a bright yellow powder, and anisal-para-aminoazobenzene, a red powder.

On the basis of our results we conclude that the ruby laser is a very valuable tool for the investigation of combination scattering spectra of colored powders.

In conclusion we wish to thank M. D. Galanin and A. M. Leontovich for placing the ruby laser at our disposal.

[1] S. P. S. Porto and D. L. Wood, J. Opt. Soc. Am. **52**, 251 (1962).

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CORRECTION TO THE ARTICLE "SCATTERING OF ELECTRONS BY ELECTRONS AT HIGH ENERGIES AND THE DIPOLE STRUCTURE OF THE ELECTRON" (JETP **42**, 1103, 1962, Soviet Phys. JETP **15**, 762, 1962).

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THE final result of the paper [Eq. (3)] contains several errors (one term is missing and several signs are incorrect). The correct expression has the form*

$$d\sigma = \frac{\pi r_0^2}{\gamma^2}\left\{F_1^4(q^2)\frac{1+\cos^4(\vartheta/2)}{4\sin^4(\vartheta/2)} + \frac{F_1^2(q^2)F_1^2(f^2)}{2\sin^2(\vartheta/2)\cos^2(\vartheta/2)}\right.$$

$$+ F_1^4(f^2)\frac{1+\sin^4(\vartheta/2)}{4\cos^4(\vartheta/2)}$$

$$+ F_1^2(q^2)\,[\mu^2F_2^2(q^2) + \lambda^2F_3^2(q^2)]\,\gamma^2\operatorname{ctg}^2\frac{\vartheta}{2}$$

$$+ F_1^2(f^2)\,[\mu^2F_2^2(f^2) + \lambda^2F_3^2(f^2)]\,\gamma^2\operatorname{tg}^2\frac{\vartheta}{2}$$

$$- \frac{1}{4}F_1^2(q^2)\,[\mu^2F_2^2(f^2) + \lambda^2F_3^2(f^2)]\,\gamma^2\operatorname{ctg}^2\frac{\vartheta}{2}$$

$$\times\left(1+\sin^2\frac{\vartheta}{2}\right) - \frac{1}{4}F_1^2(f^2)[\mu^2F_2^2(q^2)$$

$$+ \lambda^2F_3^2(q^2)]\,\gamma^2\operatorname{tg}^2\frac{\vartheta}{2}\left(1+\cos^2\frac{\vartheta}{2}\right)$$

$$+ \frac{1}{8}[\mu^2F_2^2(q^2) + \lambda^2F_3^2(q^2)]^2\gamma^4\left(1+\cos^2\frac{\vartheta}{2}\right)^2$$

$$+ \frac{1}{8}[\mu^2F_2^2(f^2) + \lambda^2F_3^2(f^2)]^2\gamma^4\left(1+\sin^2\frac{\vartheta}{2}\right)^2$$

$$- 2F_1(q^2)F_1(f^2)\,[\mu^2F_2(q^2)F_2(f^2) + \lambda^2F_3(q^2)F_3(f^2)]\,\gamma^2$$

$$+ \frac{1}{8}[(\mu^2F_2(q^2)F_2(f^2) + \lambda^2F_3(q^2)F_3(f^2))^2$$

$$- \mu^2\lambda^2(F_2(q^2)F_3(f^2)$$

$$\left.- F_2(f^2)F_3(q^2))^2]\,\gamma^4\left(2+\sin^2\frac{\vartheta}{2}\cos^2\frac{\vartheta}{2}\right)\right\}\sin\vartheta\,d\vartheta.$$

In addition, it was erroneously indicated that the experiment with the ultrarelativistic electrons aimed at determining the upper limit λ had been suggested by Avakov and Ter-Martirosyan. This was actually done by Margolis, Rosendorff, and Sirlin[1].

I am grateful to A. A. Bogush and I. S. Satsunkevich, whose remark[2] induced me to check the results.

*tg = tan, ctg = cot.

[1] Margolis, Rosendorff, and Sirlin, Phys. Rev. **114**, 1530 (1959).

[2] A. A. Bogush and I. S. Satsunkevich, JETP **44**, 303 (1963), Soviet Phys. JETP **17**, 207 (1963).

Translated by J. G. Adashko
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