Experimental Verification of the New Mounting of Concave Grating

Experimental verification of the new mounting of concave grating [reported by Mahipal Singh & K Majumdar, *Indian J. pure appl. Phys.*, 8 (1970), 201] has been reported. The source used is an iron arc. The spectra are taken in different regions at different angles of incidence and compared with the spectrum in normal incidence in the Rowland circle mounting. It is found that the result obtained gives three times better performance as compared to Rowland circle mounting. The new mounting is most suitable at an angle of incidence near about 10° for the visible region.

A new mounting, which possesses the advantages of both the Rowland circle arrangement and the Wadsworth mounting, viz. a fixed focal curve on the one hand and a sufficiently small astigmatism of spectral image on the other hand, has been studied theoretically by Singh and Majumdar.[1] Theoretically, it was found that the mounting provides a fairly good resolution and small astigmatism over quite a large wavelength range. In general, it has slightly larger amount of coma as compared to that of the Rowland circle mounting.

Recently, the author has investigated theoretically that, at an angle of incidence near 10°, the new mounting has the amount of coma of the same order as that in Rowland circle mounting in the visible region. This feature puts the new mounting at an advantage over that of Rowland circle mounting, which is well known for large amount of astigmatism. As a net result, this new mounting gives three times better performance as compared to Rowland circle mounting at normal incidence.

In this note, we report the experimental verification of the new mounting. For this purpose, the author has used a concave diffraction grating, mechanically ruled with straight grooves, having a radius of curvature 3·048 m, 56 80 lines/cm, 8·5 cm width and 4 cm as the length of the grating rulings. The source used is an iron arc. The spectra taken at angles of incidence 0°, 5° and 10° for the new mounting and at an angle of incidence 0° for the Rowland circle mounting, for the same grating and slit, have been presented in Fig. 1 in the visible region. The slit width used is 0·1 mm and the length is 8 mm.

In Fig. 1 the spectra are enlarged to the same scale. The length of the spectral images accounts for astigmatism and the breadth accounts for the coma type and other aberrations. By comparing the length and the breadth of the different spectral lines in these spectra, we found, in general, that the astigmatism is reduced by a factor of three and the coma is larger as compared to that of normal incidence Rowland circle mounting. But at an angle of incidence of 10°, the amount of coma is also of the same order as that of normal incidence for the Rowland circle mounting.

The results of the quantitative measurements of the aberrations, viz. $\Delta Z'$ (length of the astigmatic images), $\Delta\lambda$ (breadth of the spectral lines), and distance between vertical and horizontal images (d)

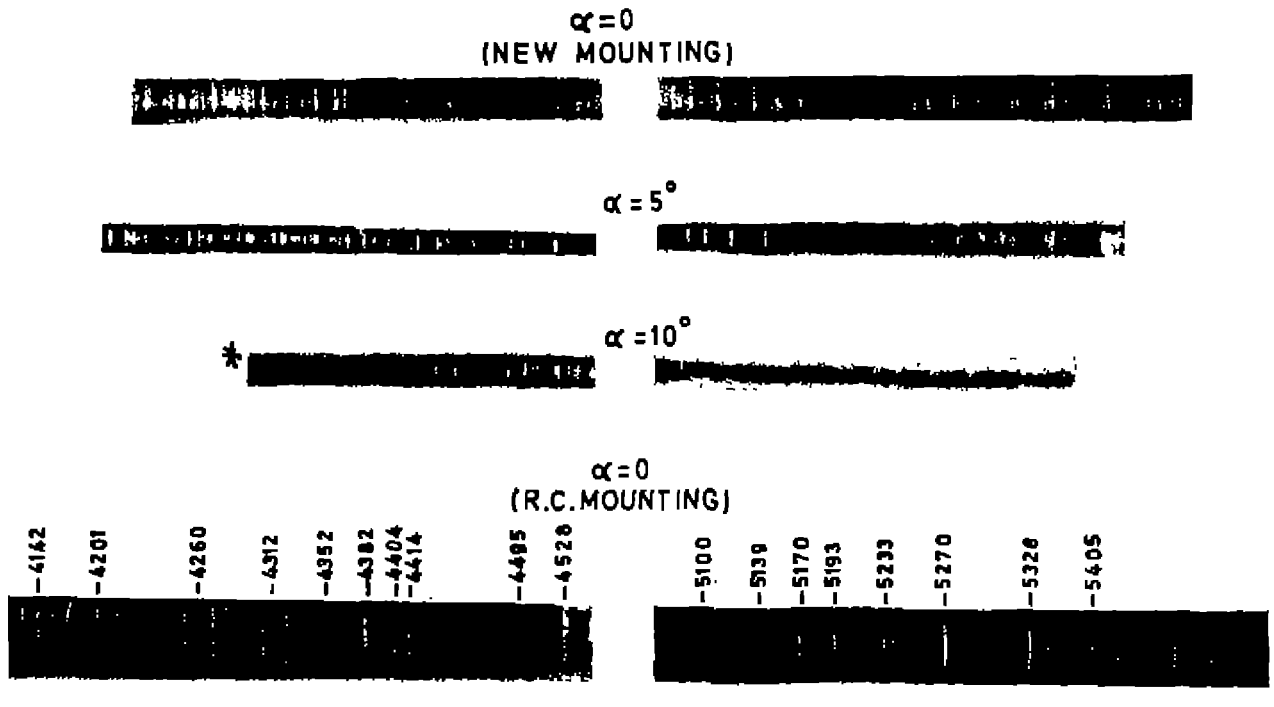

Fig. 1 — Iron arc spectra obtained from the two mountings

*IN THIS PRINT HIGHER WAVELENGTH ON LEFT

Table 1—Quantitative Measurements of the Aberrations $\Delta\lambda$, $\Delta Z'$ and (d) for the New Mounting (N.M) and Rowland Circle Mounting (R.C.M)

λ (μm)	$\Delta\lambda$ (cm) for		$\Delta Z'$ (cm) for		d (cm) for		λ (μm)	$\Delta\lambda$ (cm) for		$\Delta Z'$ (cm) for		d (cm) for	
	N.M	R.C.M	N.M	R.C.M	N.M	R.C.M		N.M.	R.C.M.	N.M.	R.C.M.	N.M.	R.C.M.
·4382	0·0576	0·0496	0·2	1·0	3	16·8	0·4467	0·0176	0·0328	0·2	0·9		
0·4404	0·0424	0·0400					0·4469	0·0144	0·0240				
0·4414	0·0368	0.0440					0·4476	0·0168	0·0280				
0·4422	0·0176	0·0192					0·4482	0 0176	0·0320				
0·4426	0·0224	0·0376					0·4491	0·0136	0 0216				
0·4430	0·0160	0·0280					0·4495	0·0144	0·0304				
0·4442	0·0280	0·0440					0·4525	0·0104	0·0240				
0·4447	0·0184	0·0360					0·4528	0·0216	0·0416	0·2	0·9	3·8	18·3
0·4459	0·0200	0·0392					0·4530	0·0112	0·0280				
0·4461	0·0200	0·0384											

(measured by using a horizontal wire in the plane of the entrance slit) at different wavelengths for new mounting at an angle of incidence 10° and for normal incidence in the Rowland circle mounting, are given in Table 1. From these results, we conclude that there is a gain in the new mounting, by a factor three as compared to normal incidence in the Rowland circle mounting.

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