APPENDIX I: *THE CZERNY-TURNER GEOMETRY*

Both monochromators used in this laboratory (HEATH, SPEX) employ the Czerny-Turner geometry illustrated in Fig. AI-1. It is easy to show that in this case, the grating equation is

$$d(\sin\alpha + \sin\beta) = m\lambda \qquad \text{(A-1)}$$

and that it can be rewritten

$$2d \cos\varphi \sin\theta = m\lambda. \qquad \text{(A-2)}$$

For first order diffraction (m=1), the dispersion in angle therefore is

$$d\lambda/d\theta = (2d\cos\varphi)\cos\theta. \qquad \text{(A-3)}$$

The reciprocal dispersion (Å/mm) is defined as

$$R = \frac{1}{f}\frac{d\lambda}{d\beta} = \frac{1}{f}\frac{d\lambda}{d\theta}$$

and can be computed from (A-3).

For a spectrometer of focal length f, we have

$$R = d\lambda/dx = (1/f)(d\lambda/d\theta) = (1/f)(2d\cos\varphi)\cos\theta$$

$$\theta = \sin^{-1}[m\lambda / 2d\cos\varphi]$$

For the two spectrometers employed here

	HEATH	SPEX
f =	0.35 m	1.0 m
φ =	17.5°	4.9°
cos φ =	0.95372	0.99634
1/d =	1180 mm^{-1}	1200 mm^{-1}.

The typical geometry for operation of a monochromator (spectrometer with entrance and exit slits), is to use equal entrance and exit slits. This introduces a factor of two so that the reciprocal linear dispersion will be (for entrance and exit slits of width x)

$$R = (1/2f)d\lambda/d\theta.$$

For reasonably small values of θ (e.g., < 20°), one can approximate $\cos\theta \cong 1$, so that the linear dispersion simplifies to $R \cong d/f$. This should be confirmed by your measurements, and you should express the dispersion in terms of Å/mm.

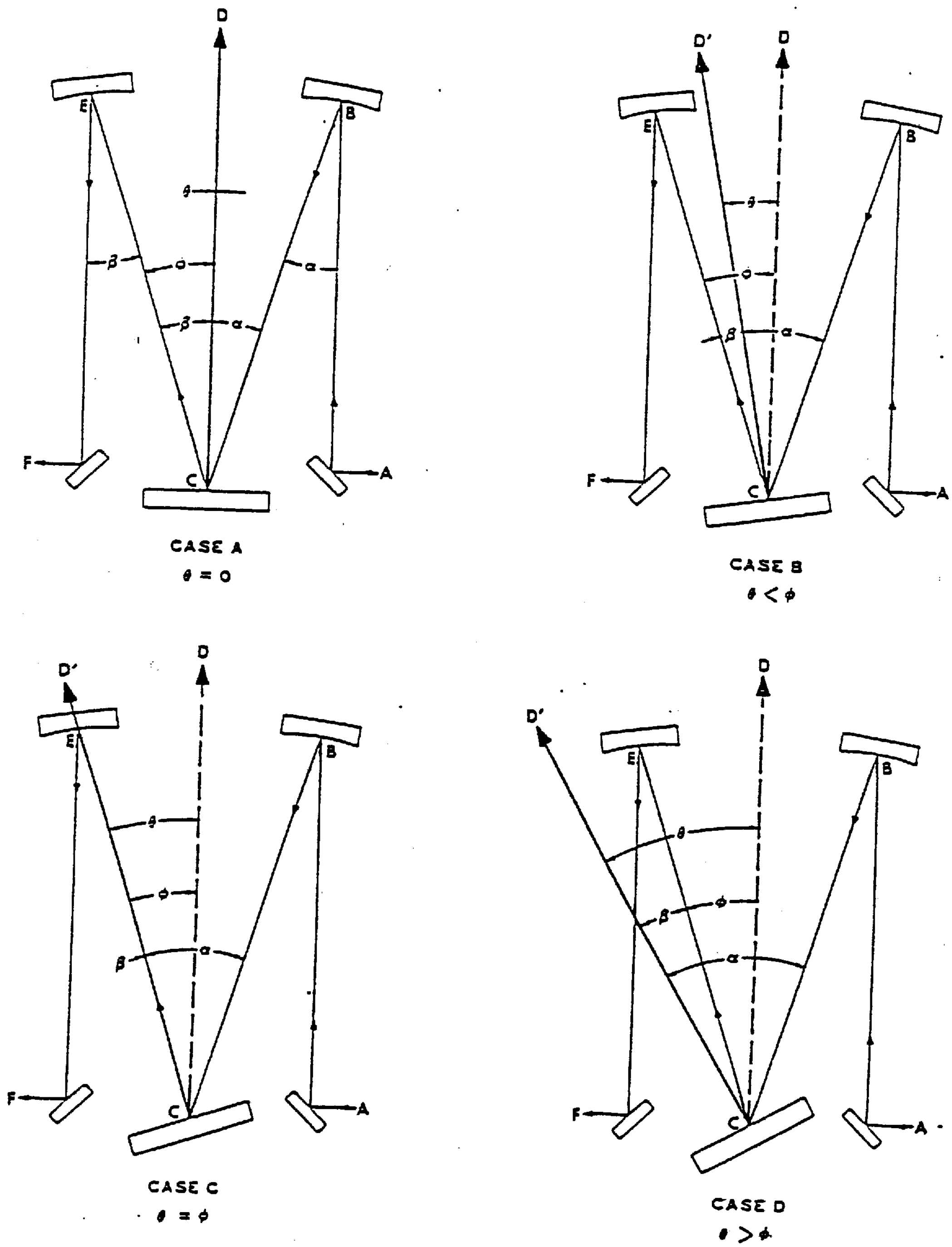

Fig. A1-1. The Czerny-Turner geometry.