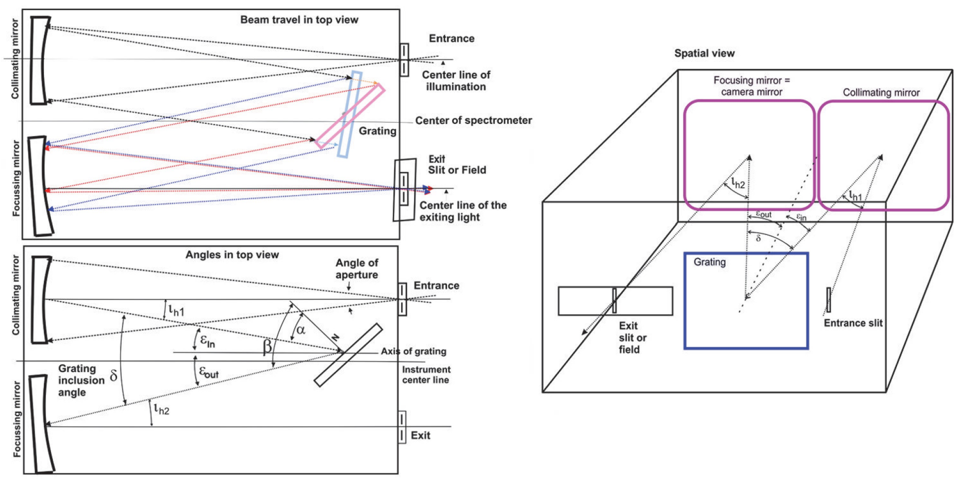

Figure 2.7 The Czerny–Turner spectrometer and its angles.

minimizes internal reflections and multiple dispersions, and eventually produces less stray light.

At the same time, as the angles α, β, and ε and the inclusion angle δ increase, the grating function and aperture are altered, which leads to decreased imaging transfer quality or more complicated correction. Furthermore, at $\varepsilon >$ 10 deg, Echelle gratings will not work properly anymore. If the monochromator application requires high slits (>*f*/20), they should be curved, as described in Section 2.6.1. This, in turn, requires a symmetric design that suffers as the angles increase. When performing imaging experiments in spectrograph mode, it is advised to use a system with imaging correction, but even then, cushion or barrel aberration will result from different traveling distances in wide instruments. A symmetric design and narrow angles will help in any case to minimize the required corrections for stigmatic transfer.

The effective area is calculated by Eqs. (2.10) and (2.11), analogous to the Ebert–Fastie setup.

2.4 Impacts and Distortions to Spectrometers

By applying Eqs. (2.1) and (2.8), one finds that the working angle ϕ describes the angle halfway between α and β. This parameter is important in the calculation of dispersion, as will be discussed in Section 2.6.4.

The equation can be described as follows:

$$m \times \lambda = k \times 2 \sin \phi. \tag{2.13}$$

The basic design can influence the internal angles. Consider the influence of the internal angles on the output wavelength of an Ebert–Fastie versus a Czerny–Turner. If ε_1 and ε_2 are equal, the Ebert–Fastie equation applies in both cases [Eqs. (2.8) and (2.9)]. α and β are positioned above and below, respectively, the