of the cells [26] (not behind the substrate!). This would require the use of thin GaAs solar cells [27] or the fabrication of Bragg reflectors [28] (a stack of thin semiconductor layers of alternating refraction indices) underneath the active layers. Bragg reflectors have been investigated for enhancing the absorption of the incoming light in very thin cells, but the reduction of the luminescent emission towards the substrate might be an additional motivation.

4.3.2 The Monochromatic Cell

It is very instructive to consider an ideal cell under monochromatic illumination. When speaking of monochromatic illumination, we mean that, in fact, the cell is illuminated by photons within a narrow interval of energy $\Delta\varepsilon$ around the central energy ε. The monochromatic cell must also prevent the luminescent radiation of energy outside the range $\Delta\varepsilon$ from escaping from the converter.

For building this device an ideal concentrator [29] can be used that collects the rays from the solar disc, with an angular acceptance of just θ_s, with a filter on the entry aperture, letting the aforementioned monochromatic illumination to pass through. This concentrator is able to produce isotropic illumination at the receiver. By a reversal of the ray directions, the rays issuing from the cell in any direction are to be found also at the entry aperture with directions within the cone of semi-angle θ_s. Those with the proper energy will escape and be emitted towards the sun. The rest will be reflected back into the cell where they will be recycled. Thus, under ideal conditions no photon will escape with energy outside the filter energy and, furthermore, the photons escaping will be sent directly back to the sun with the same étendue of the incoming bundle H_{sr}.

The current in the monochromatic cell, ΔI, will then be given by

$$\begin{aligned}\Delta I/q &\equiv i(\varepsilon, V)\Delta\varepsilon/q = (\dot{n}_s - \dot{n}_r)\Delta\varepsilon \\ &= \frac{2H_{sr}}{h^3\mathbf{c}^2}\left[\frac{\varepsilon^2\Delta\varepsilon}{\exp\left(\dfrac{\varepsilon}{kT_s}\right)-1} - \frac{\varepsilon^2\Delta\varepsilon}{\exp\left(\dfrac{\varepsilon - qV}{kT_a}\right)-1}\right]\end{aligned} \tag{4.23}$$

This equation allows for defining an equivalent cell temperature T_r,

$$\frac{\varepsilon}{kT_r} = \frac{\varepsilon - qV}{kT_a} \Rightarrow qV = \varepsilon\left(1 - \frac{T_a}{T_r}\right) \tag{4.24}$$

so that the power produced by this cell, $\Delta\dot{W}$, is

$$\begin{aligned}\Delta\dot{W} &= \frac{2H_{sr}}{h^3\mathbf{c}^2}\left[\frac{\varepsilon^3\Delta\varepsilon}{\exp\left(\dfrac{\varepsilon}{kT_s}\right)-1} - \frac{\varepsilon^3\Delta\varepsilon}{\exp\left(\dfrac{\varepsilon}{kT_r}\right)-1}\right]\left(1 - \frac{T_a}{T_r}\right) \\ &= (\dot{e}_s - \dot{e}_r)\Delta\varepsilon\left(1 - \frac{T_a}{T_r}\right)\end{aligned} \tag{4.25}$$