where the numerical factor K is about unity [125]. This type of *dispersive transport* [126] is actually rather common in noncrystalline semiconductors. The parameter α in the equation is the "dispersion parameter;" μ_h is the "microscopic mobility of holes," and ν is the "escape frequency." Typical parameters for a-Si:H at room temperature are $\alpha = 0.52$, $\mu_h = 0.5$ cm^2/Vs, and $\nu = 8 \times 10^{10}$/s [41]. For a-Si:H, the dispersive transport for holes is explained by the "trapping" of holes in localized, exponential bandtail states just above the valence band (see Figure 12.9). The dispersion parameter α is related to the valence bandtail width ΔE_V by the expression $\alpha = (k_B T/\Delta E_V)$, where $k_B T$ is the thermal energy (k_B is Boltzmann's constant and T is the temperature in kelvins). Electrons in a-Si:H also exhibit dispersive transport, but this is important only below room temperature.

How much does the space charge of holes build up under solar illumination conditions? The simple "travel time" calculation that we used for electrons is not valid for dispersive transport. Instead, we illustrate the effects of hole buildup using a computer simulation. In Figure 12.16, we have presented the electric field profiles $F(x)$ of four widely varying intensities of light; we assume that the light is absorbed uniformly throughout the absorber layer. At low intensities, the electric field is fairly uniform throughout the i-layer. As the illumination flux (and short-circuit current density) rises, the density of holes (and positive charge) builds up. At the highest intensity, the electric field "collapses" at the backside of cell (near the n-layer). In the next section we show how field collapse influences the power generated by a cell. We have chosen to

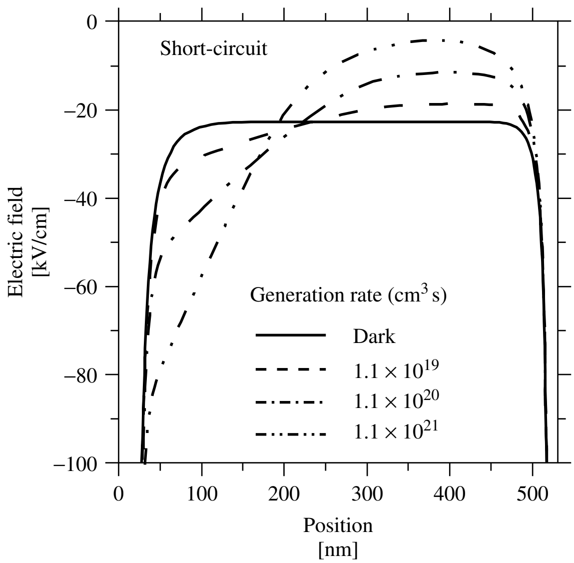

Figure 12.16 Computer calculation (cf. Figure 12.14) of the electric field profile of a *pin* solar cell for several illumination intensities; the cell is under short-circuit conditions. The illumination is uniformly absorbed ($\alpha = 5 \times 10^3$/cm) throughout the i-layer, and the corresponding photogeneration rates are indicated. At low intensities, the electric field is nearly uniform across the intrinsic layer (which starts at a position 20 nm from the origin). As the intensities increase, the electric field collapses nearly to zero close to the n-layer, which starts at 520 nm. The field becomes stronger near the p-layer. At the highest intensity, the fully collected photocurrent density is 11.5 mA/cm^2, which is about the same as that for solar illumination