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Resonance shifting: A simple, all-optical method for circumventing the reabsorption problem in luminescent concentrators NOEL GIEBINK, GARY WIEDERRECHT, Argonne National Lab, MICHAEL WASIELEWSKI, Northwestern University — Luminescent concentrators (LSCs) were developed over three decades ago as a simple route to obtain high concentration ratio for photovoltaic cells without tracking the sun. In principle, high concentration ratios >100 are possible for commonly used chromophores. In practice, however, there is typically an overlap between the chromophore absorption and emission spectra that, although small, ultimately leads to unacceptable reabsorption losses, limiting the concentration ratio to ∼10 and hence the utility of LSCs to date. We introduce a simple, all-optical means of avoiding reabsorption loss by "resonance shifting" from a bilayer cavity that consists of an absorber/emitter waveguide lying upon a low refractive index layer supported by a transparent substrate. Emission is evanescently coupled into the substrate at sharply defined angles and hence, by varying the cavity thickness over the device area, the original absorption resonance can be avoided at each bounce, allowing for extremely low propagation loss to the substrate edges and hence an increase in the optical concentration ratio. We validate this concept for absorber/emitter layers composed of both a typical luminescent polymer and inorganic semiconductor nanocrystals, demonstrating near-lossless propagation in each case.

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