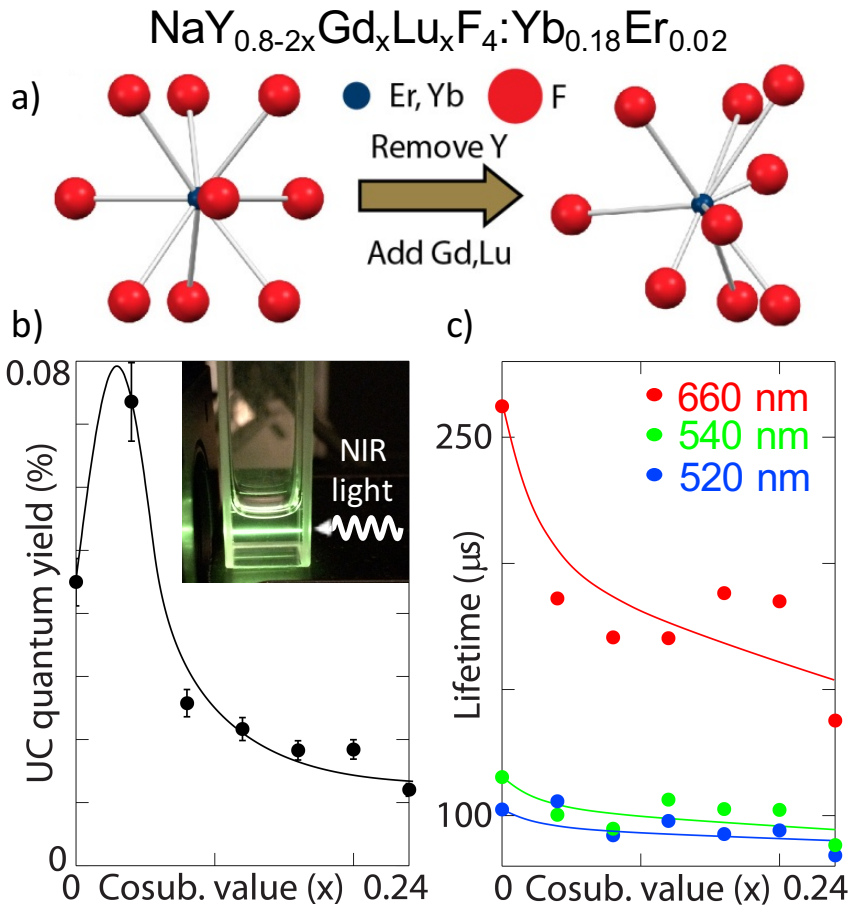
# Record efficiency in NIR-to-visible photon upconversion

*October 2016 Research Highlight*




*a) Schematic depicting the cosubstitution-induced distortions; b) UC quantum yield versus cosubstitution value (x) and (inset) a photo of the x = 0.04 sample illuminated with NIR light; c) Lifetimes of the visible-wavelength emission bands in $Er^{3+}$ as a function of x*

Work was performed at Stanford University and Lawrence Berkeley National Laboratory

## Scientific Achievement

**Demonstrated record performance by addressing a fundamental problem in near-infrared-to-visible upconverting nanoparticles, proving a path toward low-cost, high-efficiency single-junction solar cells.**

## Significance and Impact

**Lanthanide-based NIR-to-visible upconverters have low efficiencies due largely to the parity-forbidden nature of *f-f* optical transitions. Here, we overcome this limitation by distorting the host lattice and in so doing achieve a record upconversion efficiency.**

## Research Details

- Synthetic cosubstitution engenders local distortions which make the *f-f* transitions comprising UC more probable
- Slight cosubstitution yields a 1.6x quantum yield boost
- Concurrent lifetime drop evinces probability increase
- Additional characterization confirms symmetry distortion as the source of the UC quantum yield enhancement

M. D. Wisser, S. Fischer, P. C. Maurer, N. D. Bronstein, S. Chu, A. P. Alivisatos, A. Salleo, and J. A. Dionne. *ACS Photonics* **2016**, *3* (8), pp. 1523-1530

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