Researchers built a constellation of complexes that point the way to molecular structures and associated models that can improve the efficiency of light-driven chemistry to separate cerium. Credit: Journal of American Chemical Society

Inside smartphones and computer displays are metals known as the rare earths. Mining and purifying these metals involves waste- and energy-intense processes. Better processes are needed. Previous work has shown that specific rare earth elements absorb light energy that can change their chemical behavior and make them easier to separate. Now, researchers have revealed how certain molecular structures can improve the efficiency of this light-driven chemistry to separate cerium, a rare earth element.

The 17 rare earth elements are chemically similar.
of key structural features that enabled predictive and tunable quantum yields, and therefore brightness. Moreover, the team performed comprehensive computational analyses of guanidinate-amide and guanidinate-aryloxide luminescent cerium(III) complexes. The computational data afforded rationalization of the differences in Stokes shifts (luminescent colors) of these compounds. These quantitative structure-luminescence models are expected to contribute to the photoredox separations of rare-earth-containing products whose 4f-5d electronic transitions can be tuned and exploited in the visible and ultraviolet range for efficient, green, and potentially low cost photochemical-based separations.


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