Single-Site Linear Light Upconversion at the Molecular Level

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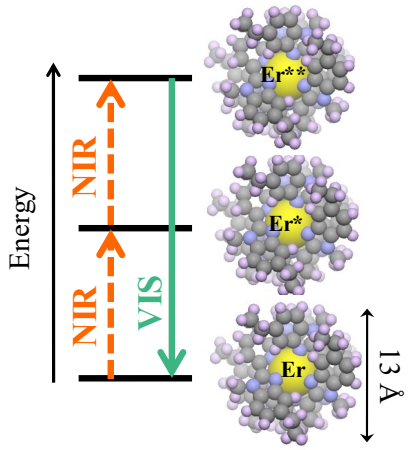
With the fast growth of lanthanide-containing luminescent nanoparticles during the last few years, linear light-upconversion, that is the conversion of near-infrared (NIR) light into emitted visible light by successive linear absorption of NIR photons, a phenomenon which was well-known in doped ionic solids and garnets, entered the nanoscale dimension.[1] The next miniaturizing step aims at reaching linear light upconversion at the molecular level. Achieving this goal however requires the piling up of low-energy near-infrared photons onto a single lanthanide center via excited state absorption (ESA) operating in molecular complexes. This represents an almost inconceivable tour de force in presence of the efficient non-radiative luminescence quenching processes provided by the closely located high-energy oscillators of the bound organic ligands.[2] Taking advantage of the recent rational design of trivalent erbium complexes equipped for dual emission,[3] the present work reports the first example of a compelling single-center lanthanide linear upconversion process operating at the molecular level converting 801 nm and 966 nm NIR excitation light beam into 525 nm and 542 nm visible luminescence, which might open new avenues for pushing miniaturization towards 'sub-nanophosphors' (i.e. molecules) for light-upconversion (Scheme 1).[4]



Scheme 1. Schematic representation of single-ion erbium-centered linear upconversion through excited state absorption (ESA) mechanism.

[1] Zhou J., Liu Q., Feng W., Sun Y., Li F. *Chem. Rev.* **2015**, *115*, 395.
[2] Suffren Y., Golesorkhi B., Zare D., Guénée L., Nozary H., Eliseeva S. V., Petoud S., Hauser A., Piguet C. *Inorg. Chem.* **2016**, *55*, 9964.
[3] Golesorkhi B., Guénée L., Nozary H., Fürstenberg A., Suffren Y., Eliseeva S. V., Petoud S., Hauser A., Piguet C. *Chem. Eur. J.* **2018**, *24*, 13158.
[4] Golesorkhi B., Nozary H., Guénée L., Fürstenberg A., Piguet C. *Angew. Chem. Int. Ed.* **2018**, *57*, 15172.