All-Photonic Tunable Molecular Transistor Based on Trivalent Lanthanide Ions Luminescence

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Diodes and transistors are without any doubt one of the most impactful innovations that guided the technological advances of computing and every smart device at the present day. However, the rapid technology growth towards the fourth industrial revolution (Industry 4.0) is continuously demanding further computing power [1,2]. Despite the incredible advances that lithography techniques are experiencing during the last decades, they are also about to reach their physical limits, implying that the development of alternative approaches is crucial in order to keep the technological demands,[3–6] as the semiconductor industry has worldwide stated [7]. Here, we describe the proof-of-concept of a tunable all-photonic molecular device based on a Tb^{3+}/Eu^{3+} di-nuclear complex embedded into a di-ureasil hybrid host (dU6EuTb) which responds toward light resembles the conventional electronic transistor. The system permits reversibility, contrasting with the conventional electronic components for which a new function implies a new circuitry. This is to the best of our knowledge the first example of an all-photonic device that mirrors the behaviour of a conventional transistor.

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