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Artificial Molecules PATANJALI KAMBHAMPATI, SAMUEL SEWALL, RYAN COONEY, D.M. SAGAR, McGill University — Confinement of carriers in quantum dots results in hydrogenic like states for the exciton. Thus a single excitation in a quantum dot bears resemblance to a hydrogen atom; these materials are often referred to as 'artificial atoms'. A pair of excitons will form a four body biexciton, akin to a hydrogenic molecule. Quantum confinement increases the binding energy of the ground state of the biexciton. Quantum confinement should also produce bound states for the excited states of the biexciton. Thus the excitonic 'hydrogen molecule' should have an eigenstate spectrum in the vein of molecular orbitals. The eigenstate spectrum of the biexciton has remained elusive due to the ultrafast timescale of relaxation processes in quantum dots which mask observation of the excited states. Here, we show the first, direct observation of excited states of the biexciton, completing the analogy of excitons in quantum dots to atomic and molecular systems.

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