Physicists first to create new molecule with record-setting dipole moment

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A proposed pathway to construct quantum computers may be the outcome of research by a University of Oklahoma physics team that has created a new molecule based on the interaction between a highly-excited type of atom known as a Rydberg atom and a ground-state atom. A unique property of the molecule is the large permanent dipole moment, which reacts with an electric field much like a bar magnet reacts with a magnetic field.

"This is the largest electric dipole moment ever observed in a molecule," says James Shaffer, professor in the Homer L. Dodge Department of Physics and Astronomy, OU College of Arts and Sciences. Shaffer and his team want to produce enough of these molecules to carry out future experiments on dipole interactions. Dipole interactions between particles may provide a pathway for constructing scalable quantum computers.

Donald Booth, the lead graduate student on this project, says the molecule is formed when an electron from the Rydberg atom grabs onto the ground-state atom. OU researchers excite the Rydberg atom using lasers in a cloud of ground-state atoms, so the Rydberg electron can collide with a ground-state atom and form the molecule.

A paper by OU physicist James Shaffer on this research has been published in *Science* magazine.

More information: Production of trilobite Rydberg molecule dimers with kilo-Debye permanent electric dipole moments *Science* 3 April

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