Physicists work to understand atomic collisions important to ultracold quantum gasses

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A Kansas State University physicist is continuing his study of atomic collisions with the help of a National Science Foundation grant awarded under the American Recovery and Reinvestment Act.

Brett Esry, professor of physics, received more than $282,000 from the National Science Foundation to study what happens when atoms collide in groups of three and four. These few-body collisions play an important role in experiments on ultracold quantum gasses. Esry said a better theoretical understanding of these collisions could help physicists improve design of experiments and interpretation of what has been measured. A better understanding of ultracold quantum gasses can potentially affect such technologically important phenomena as superconductivity and quantum computing.

Moreover, understanding few-body collisions can improve our understanding of chemistry in outer space, Esry said. One of the simplest reactions that forms molecules from atoms occurs when three atoms combine to form a diatomic molecule. That means these collisions play an important role in the chemistry of interstellar clouds and planetary atmospheres. At higher temperatures, these reactions become important to combustion.

Esry and his research group at K-State focus on these ultracold atomic systems and on understanding the dynamics of atoms and molecules in

intense laser fields. Esry conducts his work in K-State's J.R. Macdonald Laboratory, which is funded by the U.S. Department of Energy.

Esry also is receiving a grant from the U.S. Air Force Office of Scientific Research for the project "Ultracold polar molecules: New phases of matter for quantum information and quantum control." This effort joins 10 research groups from these institutions: Georgetown University; the James Franck Institute at the University of Chicago; the Joint Quantum Institute at the University of Maryland; JILA at the University of Colorado and also affiliated with the National Institute of Standards and Technology; Durham University in the United Kingdom; and the University of Innsbruck in Austria.

K-State's Macdonald Laboratory also is the recipient of a grant from the U.S. Department of Energy made possible by the American Recovery and Reinvestment Act. The nearly $1.3 million grant builds the infrastructure of the lab, adding a new laser system with nearly 10 times the capability of the current system, said Itzik Ben-Itzhak, the lab's director.

"This new laser system represents a substantial investment by the Department of Energy in our lab and its continued productivity, as well as a clear recognition of Kansas State University's strong commitment to our program."

With these awards, Esry and the other nine faculty who work in the lab and the larger atomic, molecular and optical physics group bring nearly $5 million dollars per year to K-State, Ben-Itzhak said.

Source: Kansas State University (news : web)