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John Twork
Illinois Wesleyan University

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DeHarak Earns \$150,000 NSF Research Grant

Sept. 25, 2017

BLOOMINGTON, Ill.— A three-year, \$150,000 grant from the National Science Foundation (NSF) will enable Illinois Wesleyan Associate Professor of [Physics](#) Bruno deHarak to lead several IWU students in researching the question: What happens when an electron – one of the fundamental building blocks of all atoms – scatters from an atom or molecule in the presence of light from a laser?

“Without the laser field, the simplest thing that can happen is ‘elastic scattering’ in which the electron and the atom do not exchange energy and continue on their way after the collision with the same energies that they had before the collision,” deHarak said.

Addition of light from a laser can cause elastically scattered electrons to absorb photons, which increases the energy of the electron. The addition of light can also cause elastically scattered electrons to emit photons, which reduces the electron’s energy. These are called laser-assisted free-free (LAFF) processes because the electron is free and not bound to an atom or molecule both before, and after, the collision.

“This work will involve experimental LAFF studies, with the broad aim of increasing our basic understanding of these processes,” deHarak said. “Particular attention will be paid looking for interference effects in LAFF experiments that use a two-color laser field, which might be used to control scattering processes.”

Along with adding to the basic understanding of the scattering processes, deHarak says this work has applications to a variety of fields, both basic and applied. For example, LAFF processes are essential to understanding the interiors and atmospheres of stars.

Free-free transitions also play a major role in the gas breakdown that occurs in electric discharges, and provide a method for laser heating of a plasma, which is a gas of ionized atoms.

The three-year grant, “Investigations of One- and Two-Color Laser -Assisted Electron Scattering,” is part of the Research at Undergraduate Institutions program at NSF. This program supports faculty in research that engages them in their professional fields, builds capacity for research at their home institution and supports the integration of research and undergraduate education.

DeHarak previously [earned an NSF Research at Undergraduate Institutions grant in 2014](#).



Bruno deHarak

By John Twork