

# Physics Advance Leads to a Better Understanding of Optics at the Atomic Scale

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An advance by North Carolina State University physicists improves our understanding of how light interacts with matter, and could make possible the development of new integrated-circuit technologies that result in faster computers that use less energy.

Distinguished University Professor Dr. David Aspnes and post-doctoral Research Associate Dr. Eric Adles published a paper in the April 15 issue of *Physical Review B* on second-harmonic generation - or how wavelengths of light are shortened upon interaction with materials. The editors highlighted the work as an exceptional paper in the issue.

Aspnes explains that the research could be used to further our understanding of how materials bond to each other - such as silicon and next-generation insulating materials for integrated-circuit technologies. Application of this advance could aid researchers in selecting and processing materials that bond to silicon more uniformly, resulting in faster computers that utilize energy more efficiently.

Adles says the research allows scientists and engineers to use nonlinear-optical spectroscopy - which examines light reflected, absorbed or produced by a substance to determine its physical properties - to obtain more accurate information on a substance at the atomic scale. For example, the research could be used to get better data on the physical properties of the "interface" - the one-atom-thick layer where two materials bond to each other. Essentially, Adles says, the results provide a "key" that can be used by researchers to analyze spectroscopy data.

Previously, scientists could collect such data on the interface, but had no means of interpreting it correctly on the atomic scale.

Aspnes says the goal of the research was to "improve our understanding of how things work," but notes that it also gives others the tools to better analyze data and therefore gives manufacturers and industry scientists the opportunity to make better decisions about how best to move forward.

Aspnes is a professor of physics at NC State and a member of the National Academy of Sciences.

Source: North Carolina State University

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