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A Different Light (Kepler)

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A bright idea that's been around for centuries

By Tim Obermiller

A Different Light

To understand micro-optical technology, there's one very important fact you need to know: light can carry momentum. "It can hit something and have a mechanical effect," says Associate Professor of Physics Gabriel Spalding. "It's not the way we normally think of light."

The photon particles that make up light can slam into an object, creating a billiard ball effect, Spalding explains. Light also carries an electromagnetic field that can influence matter. Both effects are useful.

Johannes Kepler first discovered that light has force.

In the early 1600s, the German astronomer Johannes Kepler (left) first noticed the mechanical force of light by watching comets. Whether they were moving toward or away from the sun, the comets' tails always pointed away. Kepler assumed, correctly, that sunlight caused this effect. It inspired the astronomer to write the first science-fiction story about space travel. In it, a traveler floats to the moon on a kind of solar sail powered by a stream of light.

"And here, in 2004, we expect to see the first solar sails launched," Spalding notes. However, taming the energy of light on this scale represents a "tremendous engineering challenge," he adds. The reason that light doesn't exert much force in the world around us is because "light fields are shaking so fast that most things just can't respond. … And so most things are just going to sit there when light is hitting them." The electrons within materials are the only parts which can respond quickly enough, and the resulting forces on objects are not typically enough to overcome their weight.

However, that isn't true on the microscopic scale, where Spalding focuses his research, and where even the little force created by light can mean a lot.