Scientists have made another breakthrough in using light to build molecules and complex structures, and it could eventually bring lightsabers to reality.

Scientists have figured out how to assemble light particles into molecules, paving the way towards complex, weightless structures made of light — and someday, maybe even lightsabers. The team of theoretical physicists from the National Institute of Standards and Technology (NIST) published their findings in Physical Review Letters on September 16th.

The paper explores how to bind photons into a structure similar to a molecule of hydrogen gas containing two hydrogen atoms. The photons can sit beside each other and maintain their distance even while the molecule travels through space.

Previous research had discovered a binding process that would superimpose photons so that they lie on top of each other. In 2013, scientists from Harvard and MIT created light-matter by firing photons into a cloud of atoms that had been cooled down almost to absolute zero, bringing the atoms to a standstill. Instead of zipping through the atoms as light normally does, the photons interacted with the frozen atoms as if they were particles of regular matter. They eventually slowed down enough to bind together.

But this new model is a breakthrough; it’s “the first time anyone has shown how to bind two photons a finite distance apart,” according to Alexey Gorshkov, a scientist at NIST.
The technique needs a bit of refinement before we can make lightsabers a reality. For now, building even the tiniest, simplest molecular structures of light requires an entire lab’s worth of equipment and carefully controlled conditions. But we’re well on our way to using this concept to improve many existing applications, like communications technologies and high-definition imaging.

For example, engineers can calibrate light sensors more accurately by manipulating interactions between individual photons. We may also be able to switch over to using photons instead of electricity for information processing, which would revolutionize the computer industry and conserve a considerable amount of energy.

As physicists expand their control over the photon-binding process, they will also learn more about light and perhaps change the way we think about these nimble, massless particles. And yes, eventually we may be able to harness light’s energy into that most elegant of weapons — the lightsaber.