# Why do atoms stick together?

A proposal submitted to the Lego Institute for Lego Investigation

## 1 Background

Atoms in the observable universe have clear physical properties that we understand. For example, they are rectangular in shape. Based on their stacking properties, we know that they bond together only in certain directions forming periodic spacing of atoms, i.e., crystals, as shown in Fig. 1. We know that they obey the laws of quantum mechanics, as they only emit light at certain wavelengths or colors. However, our ignorance about atoms far outweighs our knowledge. For example, why do atoms stick together to form everything we see?

The latter question has drawn intense theoretical interest in the the past two decades. Many competing theories have been proposed. One suggests that atoms are held by electrostatic forces; however, such a theory fails to explain why atoms only stick together in a particular direction. Another theory suggests that each atom contains posts on one side and holes for the posts on the other. Two atoms come together by aligning their posts into their partner's adjacent holes. While this theory overcomes the aforementioned directionality problem, it clearly is wrong because it would break the beautiful mathematical symmetries that we have come to love in hyperrectangular atoms. Others have postulated a new force: the strong atomic force, which is both strong enough to hold the atoms but asymmetrical to produce the one-dimensional crystals that we experience everyday.

During my tenure as a graduate student at Block University in Yellow, MA, I learned to classify atoms by color and size, helping to compile the first periodic table with my advisor, Dmitri Legoleev. During my postdoc at Legolon Labs, I published additional work investigating the space between atoms in crystals. I now propose that the Lego Institute for Lego Investigations fund me for the next part of my project, breaking crystals of atoms apart and studying them in isolation.

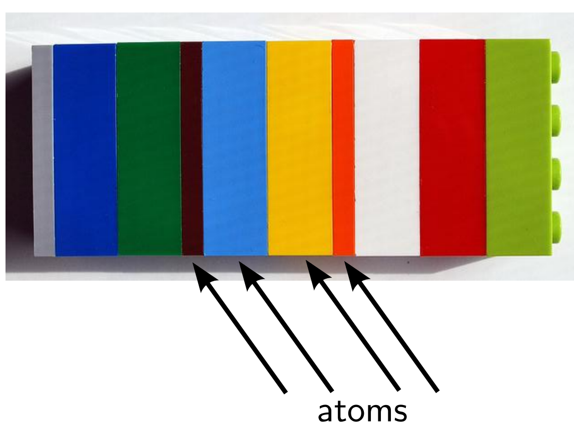


Figure 1: Microscopic image of a crystal of atoms, with four individual atoms of the crystal highlighted.

## 2 Let's separate them!

To probe these theories, we must separate atoms in crystals. I have three ideas for accomplishing this goal:

1. **Build an atom smasher:** We can build a device to hurl crystals of atoms at each other at breakneck speeds. When they collide the impulse of the collision may be enough to break the atoms apart. As a first test for this idea, we can merely throw crystals at each other and see if we can break them apart.

2. **Laser ablation:** Lasers have thusfar been used for multiple applications (see Refs. [1–4] for a random sample). If we fire a laser at crystals of atoms, we may be able to heat the crystal above its melting point, causing the atoms to break apart under the thermal strain. However, estimates as to the strength of the force between atoms suggests that we may need to build a rather large laser and possibly strap it to a shark.

3. **Pulling them apart:** A final idea is to use Scotch tape to try to pull the atoms of a crystal apart. We can place tape at the ends of the crystal and then pull on the tape. If the tape holds, we can repeat this process until we isolate a single atom. While this idea may sound crazy, it has already worked and garnered a Nobel prize [5], and at the very least, we will douse ourselves with x-rays [6].

Understanding how atoms are held together will open up the doors to countless areas of research. We can, once we have isolated atoms, build crystals of all one color atoms. Such crystals might have useful applications in vision tests. We can also mix colors of atoms into different crystals - the possibilities here are endless. It is possible that with new crystals we can find a cure for the disease of baldness with circular ridge head or find a crystal to help us walk without stumbling on all those circular humps in the road. Truly, manipulating atoms and the solids they make will allow us to transform the world.

## References


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