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The Tale of the Accidental Heat Trap

An interview with **Alireza Nojeh**, Professor, UBC Electrical and Computer Engineering
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My research is in the area of nanotechnology. Roughly speaking, think about scaling me down by a billion times, you would get a nanomaterial. In particular, my group looks at the excitation and transport of electrons within materials, and that, you can imagine, is at the base of many things in the modern world. And in particular, we are very interested in the interaction of light with nanomaterials.

How does your research work?

The area that we are currently focussing on is something that we stumbled upon accidentally during some experiments, and that's an effect that we call a heat trap. What it consists of is illuminating a collection of carbon nanotubes with a focussed beam of light; the material absorbs the light and gets heated. Although this is a conductive material - you would expect the heat to go everywhere - it actually gets very strongly confined where you generate the heat, hence the name heat trap. What that allows you is to reach a very high temperature, upwards of 1500 degrees, using a very small amount of input light. Once you heat the material to that degree, all sorts of interesting things happen.

It makes it a lot easier to create a focussed beam of electrons for applications that range from energy conversion to harvest sunlight or harvest waste heat and generate electricity, all the way to a simple and compact electron microscope.

What is the role of imagination in research?

Thinking about imagination and playfulness in science, I like to think of it as guided imagination. One normally does start with a hypothesis or a direction of thought, but it's very important to keep an open mind. Normally in the scientific process, you're not looking to prove a hypothesis, you're trying to refute it, so you try to throw at it whatever you can, and in the process see what else captures your attention. And the heat trap effect that I mentioned was precisely like this. Like I said, we had no reason to put that green laser on this material, and we thought, let's do it and see what happens.