MILDRED DRESSELHAUS

Mildred Dresselhaus was an American physicist and nanotechnologist, a pioneer in the study of nanomaterials. Dresselhaus was born into an immigrant family of extremely humble origins, who endured very hard times during the Great Depression. However, that did not discourage her from pursuing a career in science. Dresselhaus earned numerous awards throughout her life, including the Presidential Medal of Freedom, the National Medal of Science and Engineering, the Enrico Fermi Award, and the Vannevar Bush Award. Likewise, she Dresselhaus stood out for her defense of the integration of women in science.

"I have loved my job at MIT all these years, I could not have had a more interesting job [...]: every day, every year, is always different "

The Queen of Carbon

Dresselhaus was especially noted for his work on graphite, graphite intercalation compounds, fullerenes, and carbon nanotubes. The more than 1,700 works of hers on the subject and the co-authorship of eight of her books have earned her the nickname Queen of Carbon. Several physical theories are named after Dresselhaus, including the Hicks-Dresselhaus model and the SFDD model, which have helped to understand the band structure of this material. Some of her best-known work focused on discovering the electrical properties of carbon nanotubes and the thermoelectric properties of nanowires.

Experiment: Create different Moire patterns

Did you know that the graphite in a pencil is made up of layers of graphene superimposed one on top of each other? Every time you write with a pencil on paper you are delaminating the pencil, and depositing thousands of those layers of graphene. Graphene is a very special material, with unique properties. Condensed matter physicists do not stop discovering new properties and states of matter associated with how electrons behave in this material. One of the most interesting experiments of the last 4 years has been the discovery of new quantum properties of electrons in graphene when two sheets of graphene overlap and form moiré patterns.

In this experiment we are going to demonstrate the creation of different Moire patterns by rotation and translation of two superimposed lattices:

What you need

1. On a sheet of paper, make a design of a hexagonal grid of the "honeycomb" type or like the grid of the honeycombs. You can also use powerpoint. Basically what you have to do is have a pattern of a regular hexagon, and repeat this pattern over the entire surface of the sheet without leaving any empty space. The result has to be like this (this is done with power point). The smaller the initial hexagon, the more hexagons you can put on the paper. Use one of the two colors for this pattern
2. Repeat the same exercise, but this time on transparent, tracing or semi-transparent paper. If you don't have a piece of paper like this, you can also do it on an identical piece of paper and then use a light behind the two, which helps to see the two superimposed patterns. In this second pattern use another color of marker.
3. Repeat the exercise but now with hexagons slightly different in size (larger or small, does not matter)
4. You now should have two identical papers (except that they are of a different color) and a third one which is almost identical, but with slightly larger or smaller pattern.
5. Superimpose the two different size patterns one on top of the other. If you leave one fixed and move the other you will see that different moire patterns appear.
6. The most interesting ones are obtained by rotating the two identical papers one pattern with respect to the other. Use a thumbtack to ensure that the two patterns don't shift. Then begin to rotate one pattern over the other.

1. What happens?
2. Do you see a new periodicity?
3. How does this periodicity depend on the angle of rotation?

More information

Kavli Prize | Graphite | Interview | Nature Article | Carbon Nanotubes

iACS INSTITUTE FOR ADVANCED COMPUTATIONAL SCIENCE

Stony Brook University