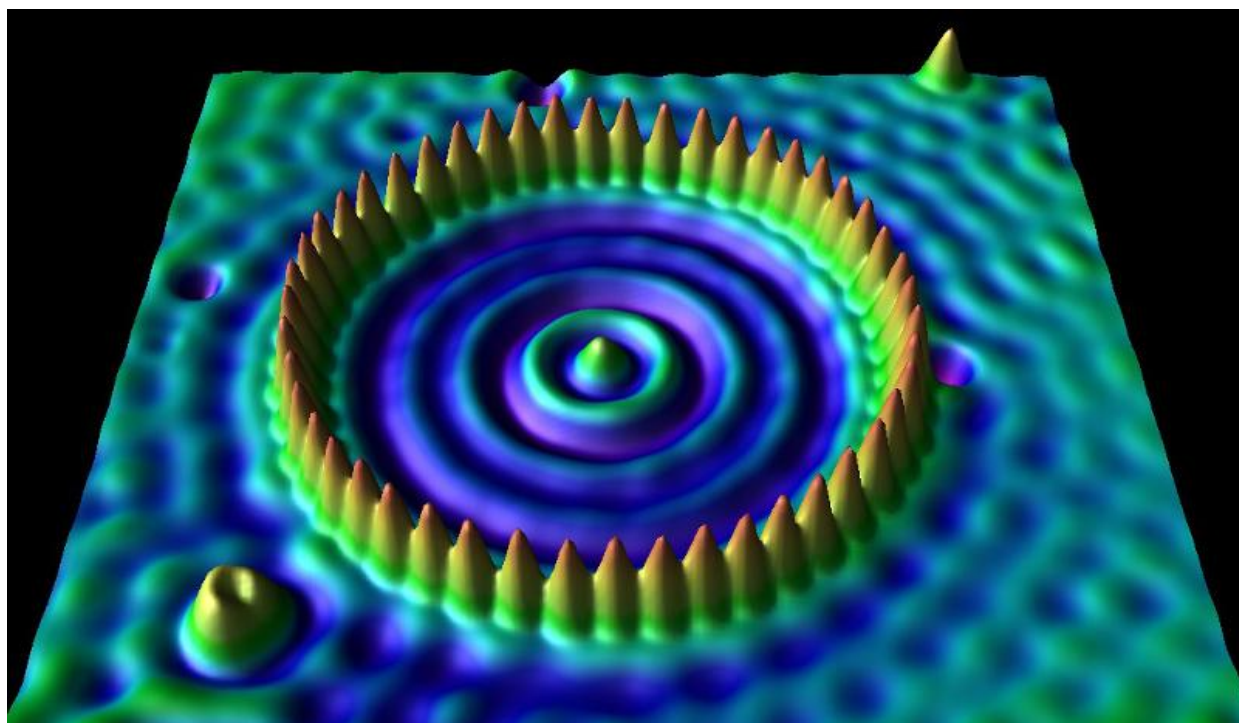


Condensed Matter Physics



Contents

1	'What do you know about Condensed Matter Physics?' - 5min	2
2	Condensed Matter Physics in daily life - 10min	2
3	The more we are, the more different it is! - 20min - [Activity]	2
4	The role of probability - 20min - [Activity]	3

1 'What do you know about Condensed Matter Physics?' - 5min

The goal of this section is to see what every kid knows about condensed matter physics and to allow them to get progressively into the subject by thinking about it by themselves. At the end of these five minutes, the following explanation should be given to the whole group so that they have a good idea about what the activities are going to be related with: Condensed matter physics is a science that studies the properties of liquids and solids by trying to understand how their microscopic structure is related to the behavior we see in normal life.

2 Condensed Matter Physics in daily life - 10min

Ask the kids what objects or fields related with daily life can be a subject of study for condensed matter physicists.

Here are some answers that you can give the kids:

Sport tissue materials, Aerospace materials, Car structures (making them safer and lighter, with for example, the use of carbon fiber), Neurophysics (how electric current goes from neuron to neuron) and even the computers of the future ! So as we see, condensed matter physics is an extremely large field.

3 The more we are, the more different it is! - 20min - [Activity]

One of the main aspects of condensed matter physics is that it studies the behavior of many particles at the same time instead of the behavior of a single particle. To show that these behaviors are really different, we are going to do an activity.

Kids should stand in a grid (see powerpoint). One of them is the source and another one is the detector. The source is given a piece of paper that represents a particle. We will proceed step by step.

Here are the rules to follow:

The 'source' is going to give the piece of paper to a kid next to him, the one that is in the direction of the detector.

When a kid receives a **single** particle, he keeps it first and in the next step he is going to give it to the kid that is in the same direction. (so the particle does not change its direction) If there is no kid in such position he gives the particle to the kid from which he received it (the particle bounces back).

If in a step a kid receives **more than one** particle, he keeps them and in the next step he gives them randomly to his neighbors. That represents a collision.

The role of the detector is only to keep the particles he receives.

First we have one source and one receptor (see powerpoint). The particle will go from the first to the second without collisions. Count the number of steps it took.

Now, we have a setup in which our source gives a particle marked in a color, so that we can follow it. There are also many other sources that send a particle in the first step. Now following the rules we stated, the trajectory of the coloured particle should not be a straight line. Count the number of needed steps for that particle to reach the detector, it can take a long time !

4 The role of probability - 20min - [Activity]

We now do the exact same experience but with two detectors (see powerpoint). Every time we do the experience it ends when all the particles have been collected by the detectors. Repeat the experience several times. In the end you will see that the majority of times the detector that is closer to the source has collected more particles than the one that is far away from it.

Tell the kids that the reason for which we use statistics to try to understand the behavior of systems with many particles is because we can not follow every trajectory so we just look at the averages values (what the majority does).