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Evaluation of light scattering and absorption in aerosol nanowires

When thinking of Physics, one might remember *the laws of motion*, such as Newton's third law stating that every action has an equal and opposite reaction, and other specific aspects they have heard about in school but in fact Physics is composed of many different fields. Some of them study atoms or molecules, other study the behavior of liquids or solids and all of these fields are parts of Physics. One of those specializes in effects and phenomena occurring at a very small scale and that is *Nanoscience*.

Nanoscience covers the creation of *nanoscale* objects, with a size of one millionth of a millimeter or 10^{-9} meters, and studying their properties, some of which are quite exotic due to the scale involved. Due to those properties, information can be stored on nanoscale devices, making it possible for hard-disks to be so small while being able to store large amounts of information.

One of the nanoscale objects widely investigated at Lund university is the *nanowire,* a wire with a typical diameter of 20 to 200 *nanometers* (10^{-9} meters) and typical length of a few *micrometers* (10^{-6} meters). The nanowires can be used to create solar cells, light detectors or light-emitting diodes (LEDs) for example. Their interaction with light resembles the headlights of a car shining through fog - instead of illuminating a big area of the road ahead, the light gets scattered and remains is a smaller area just in front of the headlights (see fig.1). In a similar manner the light shone through nanowires is disturbed from its initial course; however, the disturbance in the path carries information about the shape, size and density of the nanowires. That information is especially important if the nanowires are to be a part of a device or a solar cell since that can show the quality of the batch.

Figure 1: Headlights of a car in fog. The picture is taken from https://www.travelers.com/resources/auto/safe-driving/driving-in-fog-safely.

The ultimate goal would be to decode that information but since a calculation like that demands too much time and resources, the aim of this particular project was to determine when a nanowire can be considered infinitely long, if possible, since that can simplify the calculations of some properties it has. To achieve that, computer simulations of finite and infinite nanowires were done and the results were compared.

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