Scalar Fields Encyclopedia Article

Scalar Fields

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Scalar Fields

A field is an object which has a set of numerical values for each point in **space-time**. A scalar field is the simplest example of a field. A scalar field is an object which has a single number as its value at each point in space-time. A familiar example is the **temperature** field in a room. At every point in the room, the temperature field has a single numerical value. The values of the temperature field are higher near sources of **heat**, such as heating vents, and lower near sinks of heat, such as leaky windows.

Scalar fields are the simplest type of field because they have only two numbers associated with them at each point; two numbers, because scalar fields may be complex numbers. If a **quantum theory** of scalar fields is constructed, it is found that scalar fields have no spin. Because of this fact, they cannot describe any of the common particles such as electrons and photons. In order to describe these particles, we must use more complicated fields called spinor and vector fields, respectively, which have four or more components each.

Scalar fields are very important in theoretical **particle physics**, although there is no direct evidence yet for their existence. The **Higgs boson**, which is required for the standard model to be logically consistent, is a scalar particle. Many of the superpartners, particles predicted by supersymmetry and **string theory**, are scalar particles. Detection of scalar particles would therefore give physicists strong clues about the more fundamental theories behind the standard model.