



GST 08 – Space-Time and Physical Existence

Formal Description

Space-time is defined as a single continuum comprising three dimensions of space and one of time within which all physical entities, processes, and interactions are realised.

The term *physical* refers to anything that exists within, or constitutes, space-time, including matter, energy, and the fields and structures that occupy or define it.

All empirically observed entities, relationships, and events occur within space-time. There is no empirical evidence of any non-physical entity interacting with the physical universe. If non-physical entities exist, they have no demonstrated causal influence on physical systems.

Plain English Explanation

To understand systems, we first need to understand what we mean by *reality*.

Everything we can observe, i.e., objects, energy, light, living organisms, and even empty space, exists within a framework called space-time.

You can think of space-time as the “stage” on which everything happens. It includes:

- three dimensions of space (length, width, height)
- one dimension of time (change and sequence)

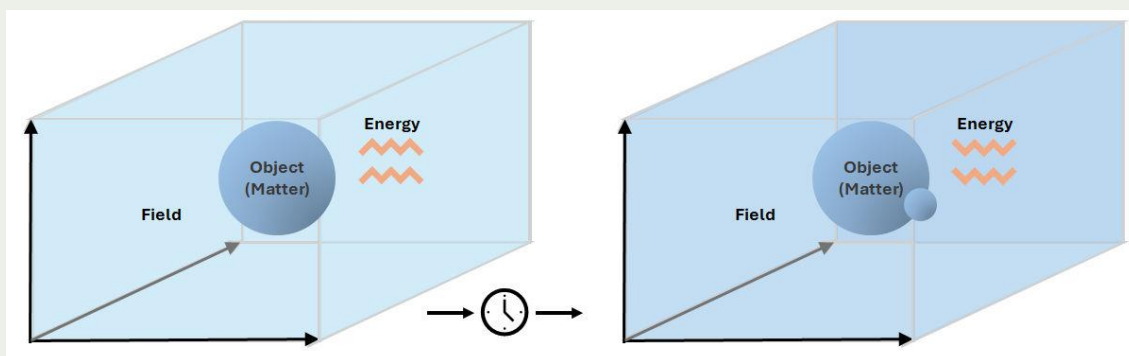
Everything we experience happens somewhere and at some time. That is what it means to say something is *physical*.

People sometimes talk about things that are “non-physical” or “beyond reality.” However, in science, we only work with what can be observed or measured. So far, there is no evidence of anything outside space-time interacting with the physical world.

This does not prove that non-physical things do not exist. It simply means:

👉 Everything we can study and understand scientifically exists within space-time.

This gives us a solid foundation for systems theory.



Example 1 – Physical Object

A football on a field exists in space (it has a position and size) and in time (it moves, slows down, and eventually stops). Its behaviour can be measured and predicted using physical laws.

👉 This is a clear example of something existing within space-time.



Example 2 – Light from the Sun

Light travels from the Sun to the Earth across space and takes about 8 minutes to arrive. This journey occurs across both space and time and can be measured precisely.

☞ Even something as intangible as light exists and behaves within space-time.

Example 3 – Empty Space

Even regions of “empty” space are not truly empty. They contain fields and can transmit energy and radiation.

☞ So space itself is part of physical reality, not separate from it.

Provenance and Links

This module draws on foundational concepts from modern physics and the philosophy of science. The concept of space-time as a unified continuum originates in the work of Albert Einstein, particularly in the development of general relativity, where space and time are treated as a single interconnected framework within which all physical processes occur.

The understanding of matter, energy, and fields as fundamental components of reality is central to contemporary physics, including quantum field theory, in which fields are treated as the underlying structure of physical existence.

The position that all empirically observable phenomena occur within space-time, and that there is no evidence of non-physical entities interacting causally with the physical universe, aligns with a broadly physicalist and empirically grounded view of reality as discussed in modern philosophy of science (e.g. Sean Carroll).

Within General Systems Theory, this provides the ontological foundation for defining entities, relationships, and processes as physically instantiated and embedded within space-time.

Practical Exercise

Look around your immediate environment (room, outdoors, or a public space).

1. Identify three different things you can observe (e.g. an object, a person, a source of energy such as light).
2. For each one, briefly describe:
 - Where it is located (space)
 - How it is changing or could change over time
3. Now consider:
 - Can you identify anything in your environment that does **not** exist in space-time?

☞ Write a short paragraph explaining your answer.