In our journey we aim – in the spirit of the philosophy of science – to understand the nature of scientific knowledge, its justification, and its limits.
This lecture focuses on three major topics: (Neo)Positivism, Karl Popper’s falsificationism, and the post-Popperian debate.

**1. (Neo)Positivism**

**Origins and Core Principles**

Rooted in Auguste Comte’s **positivism** (19th century), later developed into **logical positivism** (or neo-positivism) in the 1920s. Neo-positivism emphasized **empirical verification** as the criterion for meaningful statements. Some prominent figures are the **Vienna Circle**, including Moritz Schlick, Rudolf Carnap, and Otto Neurath.

As mentioned neo-positivismfocused on the **Verification Principle**, declaring that a statement is meaningful only if it is empirically verifiable or analytically true (tautology). From this follows that **scientific knowledge** – that is anempirical knowledge – is the only intellectual activity that has a meaning, while metaphysical claims, theology, and ethics are considered meaningless in a cognitive sense.

The main challenges of the neopositivism consists in the fact that the verification principle itself is **not empirically verifiable**. And many scientific theories (e.g., quantum mechanics) rely on theoretical constructs that are not directly observable.

**2. Karl Popper and Falsificationism**

Popper rejected inductive reasoning (the idea that general laws can be derived from repeated observations). Example: Observing many white swans does not prove that *all* swans are white.

For Popper a scientific theory must be **testable and falsifiable**, providing as an eminent example the Einstein’s **general relativity** was tested in 1919 and could have been falsified.

There is a distinction between **Highly falsifiable theories** (e.g., Newtonian mechanics) **Less falsifiable theories** (e.g., Freud’s psychoanalysis, which can adapt to any evidence), and the Highly falsifiable theories are the one to be chosen.

In this respect science progresses through **conjectures and refutations**: theories are tested, and those that withstand rigorous falsification are tentatively accepted. Similarly to the biological evolution: scientific theories **compete and evolve** like organisms in natural selection, seening the victory of the theory that is more fit with respect to the originating problem and the social context.

**3. Post-Popperian Debate**

**Sophisticated Falsificationism**

Not all falsifications lead to rejection of a theory.

**Imre Lakatos** proposed **research programs** with a "hard core" of fundamental assumptions protected by a "protective belt" of auxiliary hypotheses. The test of a theory should be judged on whether they lead to **novel, testable predictions**.

**Thomas Kuhn and Paradigm Shifts**

According to Kuhn’s book **The Structure of Scientific Revolutions (1962)**: science progresses through **paradigms** rather than through continuous accumulation of knowledge.

During **normal Science** period: scientists work within a prevailing paradigm and they do not question that. However in the time of **crisis and revolution**: when anomalies accumulate, a dramatic change of paradigms happens, replacing the old one with a new one (e.g., Newtonian physics → Einsteinian physics).
The major **criticism** consistis in tha fact that Kuhn’s view can be seen as **relativistic**, suggesting that scientific truth depends on social consensus rather than objective reality.

**Paul Feyerabend’s Anarchistic Science**

In **Against Method (1975)**: there is no single scientific method, *anything goes*. And Feyerabend criticized both Popper and Kuhn, arguing that science should not be privileged over other forms of knowledge. Feyerabend advocated for **methodological pluralism** and scientific freedom.