1 Introduction to cosmology

FIGURE 1.1 – Left : artistic illustration of Hindu cosmology. Right : cover of the book of Genesis, Bible of Saint-Paul-hors-des-Murs, around 870.

The purpose of this first chapter is to present modern cosmology and briefly explain its construction over the last century. The idea is to give an overview of the current paradigm, while further detailing the key points necessary for this manuscript. For an in-depth study of modern cosmology, we refer the reader to the following works : **?**, **?**.

1   What is cosmology ?

The term cosmogony (from the Greek *cosmo-* : world ; *gon-* : to engender) designates a conception and an attempt to explain the birth of the world, and sometimes of Man. There are a large number of cosmogonies, very often of religious origins. We can cite for example the Hindu cosmogony, in which the world is seen as a cycle : the god Brahma creates the world when he wakes up, and destroys it when he falls asleep. Our universe thus corresponds to a day of Brahma, beginning when Brahma opens the eyes and ending when he closes them. The world thus follows a series of creations and destructions. We can also cite the Abrahamic cosmogony, described in Genesis. This cosmogony is common to Judaism, Christianity, and Islam. In this cosmogony, the creator god, timeless, conceived the world in 7 days. He started by creating light the first day. He ended up creating Man in his image on the sixth day, then rested on the last day.

We could spend the whole of this manuscript describing various cosmogonies. But the one that interests us and that we will detail here is scientific cosmogony : *cosmology.* Cosmology is therefore the study of the universe, its origin, its constituents and its future, within the framework of the scientific method. Even if today cosmology is consensus among scientists regarding the understanding of the universe, this has not always been the case. For a long time religious beliefs have dominated, going as far as limiting or even prohibiting scientific advances. It was not until the XVI þcentury that Copernicus proposed the heliocentric model, almost 2000 years after the geocentric model of Aristotle, supported by the church and scholars until then. Subsequently, the observations of Galileo, the works of Kepler as well as the emancipation of religious dogmas allowed the heliocentric model, based on the laws of Kepler, to prevail. It also allowed Newton to come up with his theory of gravitation soon after. This period marks the birth of physics and cosmology.

Until the XIX þcentury, there was consensus on the heliocentric model describing the universe as being limited to our solar system. Then emerges the idea that stars are other solar systems, in particular thanks to the first distance measurements of close stars [1]. The idea of galaxy, a system

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1. For example the measurement of the distance of 61 Cygni by Bessel in 1838.

bringing together a multitude of solar systems, also appeared, leading us to a paradigm less and less anthropocentric.

Modern cosmology was really born at the beginning of the XX þcentury. In 1915, Einstein proposed his theory of gravitation : the *general relativity*. It offers a radically different view from Newton's well-established theory. Gravitation is no longer seen as an instantaneous force between massive bodies but as a deformation of space time propagating at the speed of light. Einstein's theory correctly predicts the advance of Mercury's perihelion, the value of which was previously misunderstood. Then in 1919 during an eclipse of the Sun, the deviation of light by a massive body, direct prediction of general relativity and not present in Newton's theory, is observed. Not only is the deflection of light observed for the first time, but the angle of deflection observed corresponds to that predicted by theory. This establishes Einstein's theory within the scientific community as a new theory of gravitation.

In addition, observational cosmology is experiencing remarkable advances, notably thanks to Send feedback History Saved Community