

# Preface

Water is one of the basic elements for life. It is even assumed that the evolution of life is only possible if there is liquid water present. A water molecule has some remarkable properties that make it quite unique in the universe. In the first chapter of this book we will review these basic properties of water and the role of water on Earth. All ancient civilizations realized the importance of water and their cities were constructed near great reservoirs of water. But is water unique on Earth? Do we find water elsewhere in the solar system, on extrasolar planetary systems or in distant galaxies? We will start the search for the presence of extraterrestrial water in our solar system. Surprisingly enough it seems that water in some form and sometimes in only minute quantities is found on any object in the solar system. Even on the planet nearest to the Sun, Mercury, there may be some water in the form of ice near its poles where never the light of Sun heats the surface. And there are objects in the solar system that are made up of a large quantity of water in terms of their mass, like comets and several satellites of the giant planets.

If life depends on the presence of liquid water, there are also places besides Earth where liquid water may be found: beneath the ice crust of several satellites of Jupiter and Saturn there might be hidden a liquid ocean. Such an ice crust provides a shielding against high energetic radiation.

Now, since the first extrasolar planetary systems have been detected, the search for water on such objects has just started. Because from observations it is very difficult to measure the spectroscopic signatures of the atmospheres of such planets, we have to wait for the newly planned observational facilities (both in space and on ground); some of them will be in operation very soon.

Water has been detected almost everywhere on extreme and exotic places in the universe: in 5000 K hot sunspots as well as in cold molecular interstellar clouds. Extreme bright sources can be explained by a MASER mechanism that is based on water molecules. They indicate regions where stars are formed and they can be even detected in galaxies that are at a distance of several 100 million light years.

Water, which consists of hydrogen and oxygen, was formed after the first generation of luminous stars exploded, so it was not present during the first several 100 million years of the history of our universe. This will be reviewed in the last chapter.

The book is intended for the reader interested in astrophysics, astrobiology and science in general. It provides an overview but since more than 350 papers are cited, the reader who wants to go deeper can use these references. It can also be used as a textbook on several topics related to astrobiology.

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