

Title:

On the challenge of detecting extraterrestrial life

Abstract:

The detection of extraterrestrial life would constitute one of the most important discoveries of Humanity. Nevertheless, in more than a hundred years of intensive search, nothing has been detected so far. This absence of detection can be explained by our limited methods of exploration with respect to the immensity of the universe. Indeed, if the probability of the existence of evolved extraterrestrial life increases with distance from the Earth, at the same time, the number of detectable biosignatures decreases due to technical and physical limitations. This competition between the probability of extraterrestrial life and its detectability constitutes the main challenge of astrobiology, the domain of science interested by the origin of life and its evolution on Earth and in the universe.

Thus, if it is now possible to explore the surface of Mars with robots, scientists expect at best to find fossilized primitive microorganisms associated with very limited and subtle biosignatures whose detection required instruments hardly compatible with space missions. On the opposite, if evolved life forms may exist on exoplanets, our methods of investigations outside the solar system are limited to (radio)telescopes only capable of detecting very specific types of biosignatures.

In order to illustrate this challenge, we will present an overview of the current astrobiological approaches implemented to detect life in the solar system and beyond, from the detection of biotic molecules on Mars to the search for extraterrestrial intelligence in the Milky Way.

Résumé:

Dr. Frédéric Foucher is research engineer at the Centre National de la Recherche Scientifique (CNRS), in the exobiology team of the Centre de Biophysique Moléculaire (CBM), in Orléans, France.

He obtained his Ph.D. in physics and material sciences at the University of Poitiers, France, in 2007. He then joined the exobiology group of the CBM as a specialist of Atomic Force Microscopy and Raman spectroscopy. In January 2017, he obtained his habilitation (HDR) in physics at the University of Orléans, France, for a HDR thesis entitled "Methodology for the search for life on Mars".

Dr. Frédéric Foucher is now working in various fields of astrobiology. In particular, he is known for his work on the detection of biosignatures in ancient terrestrial rocks and putatively in Martian rocks. He is involved in the preparation of the future ExoMars 2022 ESA/Roscosmos mission to Mars.