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Cosmic ray sonification: the COSMOPHONE

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Abstract The Cosmophone is an attempt to show the close connections existing between the infinitely small and the infinitely large in sensory terms by detecting and imaging the continuous flow of elementary particles (cosmic rays) originating from our entire galaxy.

Keywords Sonification · Moving sounds · Cosmic rays · Sound immersion

1 Introduction

Art and science are both driven by a quest for truth. The approaches used in each case are different; however, art plays on the strength of emotions, whereas science usually involves comparing theoretical concepts objectively with experimental data. But the two approaches can meet together when emotion is elicited by a direct contact with an unexpected invisible physical phenomenon. Sound immersion is an interesting way of perceiving events that are not visible: among the many differences between sound and vision is the fact that sounds produced by invisible or hidden sources can be heard and both the motion and the location of the sources can be detected by our hearing system. The Cosmophone (Official Web Site: http://cosmophone.in2p3.fr) is a 3-D sound immersion installation in which invisible cosmic particles can be perceived by listeners in terms of synthetic sounds inducing physically related sensations.

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2 The cosmic rays

Interstellar space contains a permanent flux of high-energy elementary particles called cosmic rays. These particles have been created by violent phenomena occurring somewhere in our galaxy, when a massive ancient star explodes into a supernova, for example. The particles are then confined in the galaxy for millions of years by the galactic magnetic fields before reaching our planet. When colliding with the earth's atmosphere, cosmic rays create showers of secondary particles. Although they are partly absorbed by the atmosphere, these showers induce a large range of phenomena, which are measurable at sea level. The main phenomenon is a flux of muons, a kind of heavy electron which is absent from usual matter because of its short lifetime. Muons are produced at a high rate in cosmic showers. Thanks to their outstanding penetration properties, they are able to reach the ground. At sea level, their flux is about hundred muons per second per square meter. High-energy cosmic rays produce bunches of muons, or multi-muons, having the same direction, which are spaced a few meters apart. In addition, muons occasionally interact in the air, producing dense electromagnetic showers of electrons and photons which can reach the ground.