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Nuclear metamorphosis in mercury

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The conditions of local Lorentz invariance (LLI) breakdown, obtained during neutron emission from a sonicated cylindrical bar of AISI 304 steel, were reproduced in a system made of a mole of mercury. After 3 min, a part of the liquid transformed into solid state material, in which isotopes were found with both higher and lower atomic mass with

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respect to the starting material. Changes in the atomic weight without production of gamma radiation and radionuclides are made possible by deformed space–time reactions.

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1. Introduction

A new type of nuclear reactions, called piezo-nuclear reactions, was suggested to occur in ultrasound-induced cavitation phenomena[1] when the variations of energy density correspond to a breakdown of local Lorentz invariance (hereafter LLI or "Lorentz invariance").[2]

Piezo-nuclear reactions are a particular case among the reactions occurring in deformed space–time conditions (DST-reactions).

The theoretical basic principles of these phenomena were developed in the pioneering work of Petrucci *et al.*[3] while the subsequent experimental data were the starting point for the precursor work of Mignani *et al.*,[4] which predicts that the course of the whole Aston–Bohr–Wheeler "nuclear curve" (see e.g., Refs. 4 and 5) is open in both directions.

The main steps of these investigations, looking for the LLI breakdown, concern the energy thresholds of the fundamental interactions for space–time deformations,[2] the corresponding energy density inside the "Ridolfi cavities" of metallic materials,[6,7] in particular considering the leptonic and hadronic interactions and finally the energy rate or "time density" of energy, as discussed in Ref. 2, where the transformations of time intervals in hadronic interactions are considered. Anisotropy of hadronic interactions is a consequence of the anisotropy of the hadronic metric and its variations with energy.[8]

In order to check this anisotropy, a dedicated experiment was designed and realized in Rome (Italy) in 2012[9]: the angular distribution of neutrons produced by DST-reactions in a steel bar subjected to ultrasound irradiation was registered. The experiment is based on the results previously obtained in Milan (Italy) and Cagliari (Italy) in 2010.[10–12] The crucial point in these experiments is the comparison of angular distributions with those obtained in 1999 in electromagnetic systems testing LLI violation.[13]

A further step of the path is reported in this paper. In fact, the results from the previous experiments are exploited to reach the conditions of LLI breakdown and thus to induce nuclear transformations in mercury.

The Rome experiment[9] was designed to study the spatial distribution of the neutron energy produced by means of DST-reactions. It is based on previous experiments realized in Milan and Turin, which concerned the piezo-nuclear neutron emissions from steel, ferritic iron and basalt submitted to ultrasounds.[10,12]

In the Rome experiment, a cylindrical bar of AISI 304 steel — having 9 cm height, 2 cm diameter and 180 g mass — was irradiated for 3 min by ultrasounds