



**Lecture by**  
**Dr. Enzo Bonacci**  
**on the**  
**Principle of Reciprocity**  
**in Physics**



**Enzo Bonacci** was born in Brescia (Italy) in 1972 and spent there his childhood. At the end of the 70's his family moved to Latina, city where he still lives and works; his school marks were so excellent to deserve the City Medal conferred by the Mayor. During his scientific high school he received a prize that used to study in Cambridge (UK), where he was extremely impressed with Newton's manuscripts on maths and physics.

After graduating in Chemical Engineering from "La Sapienza" University of Rome, he spent his university prize to travel the world and to achieve diplomas in numerous foreign languages.

He was chosen to do his national service at the office of the Under Secretary of Defence. In spite of his scientific education he has never neglected his artistic side, writing poems and novels selected by international literary contests and becoming a columnist for some newspapers.

Member of the *ODI* (Italian Order of Engineers) since 2001, he has become technical-scientific consultant for important boards.

After qualifying in *mathematics* and *physics*, he has been teaching at Scientific High School since 2001, holding several posts like *Responsible for Public Relations* and *Secretary of the School Council*.

In November 2003 he became responsible for the scientific project *Evolution of Rational Thinking and Epistemological Problems*. During 2004 he became responsible for the IFTS project *Transformation of Agroindustrial Products*. In January 2005 he was elected *Secretary of AEDE-Latina* (European Association of Teachers).

In October 2007 he got the cover of BLU magazine about his effort to extend Relativity and became member of the *IOP* (MInstP).

In 2008 he was selected among the 280 CBEL mathematicians and he was awarded with the Honorary Ph.D. in Theoretical Physics by the Cosmopolitan University.

# The Reciprocity as Physical Law

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## 1 SYNTHESIS

The Principle of Reciprocity is the acausal extension of Newton's third law of motion where action and reaction are equivalent; it renders account of the pre-causal phenomena noticed in Quantum Mechanics and it supports the three-dimensional hypothesis of time and the interpretation of matter as a space-time's ripple.

## 2 INTRODUCTION

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**Keywords:** action, reaction, reciprocity, matter, time

**Abstract:** In 1687 Newton enunciated the three Laws of Motion (cf. ref.[23]). The Third Law states: «Actioni contrariam semper & æqualem esse reactionem: sive corporum duorum actiones in se mutuo semper esse æquales & in partes contrarias dirigi». Since this formulation the *action-reaction* pair has always been identified with *cause-effect*. According to my opinion (cf. refs.[6-14]) it is a misinterpretation, no longer admissible after quantum physics proved the existence of interactions free from cause-effect dynamics (cf. refs.[3-5]).

## 3 THE PRINCIPLE OF RECIPROCITY

The presence in nature of some acausal phenomena described by Quantum Mechanics, *e.g.*, the electron preacceleration (cf. ref.[21]) and the EPR paradox (cf. refs.[1],[2],[20]), demands a physical description free from the binomial cause-effect for the benefit of a perfect logical symmetry and temporal reversibility.

The *reciprocity* consists in the possibility to permutate subject (cause) and direct object (effect) within a well-formulated proposition by keeping invariant its effectiveness in terms of physical description.

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## 4 MATTER AS SPACE-TIME'S RIPPLE

A first interesting consequence is the double sense interpretation of Einstein field equations  $G_{\mu\nu}=kT_{\mu\nu}$  (cf. ref.[19]) by which it is true both that a mass creates a curving space-time around it (Fig. 3.1) and on the contrary that a curving space-time creates mass inside so that matter would be just a ripple in the space-time continuum (Fig. 3.2). Thus there is not a cause (the source tensor  $T_{\mu\nu}$ ) and an effect (the Einstein tensor  $G_{\mu\nu}$ ) but the two entities are interchangeable in physical description.

Fig. 3.1

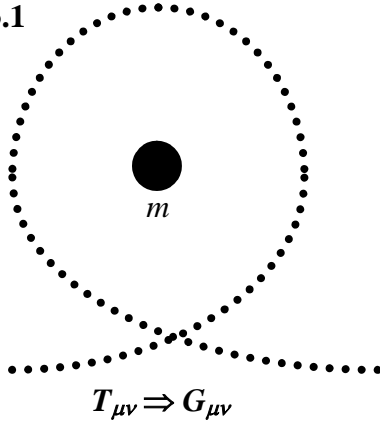
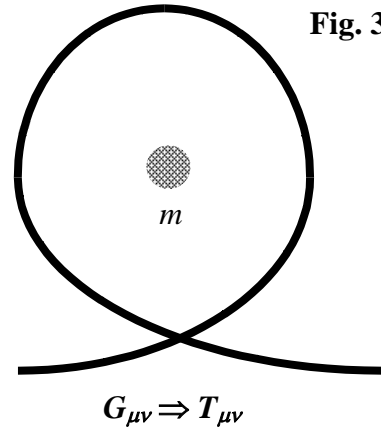


Fig. 3.2



## 5 TIME'S THREE-DIMENSIONALITY

A second interesting consequence is the double sense interpretation of Fitzgerald contraction  $\Delta x = \Delta x_0 / \gamma$  (cf. ref.[18]) by which it is both true that the speed of the body generates the length's contraction in the movement direction and vice versa that the length's contraction in a certain direction generates the speed of the body.

By applying the Reciprocity Principle also to time's dilatation  $\Delta t = \gamma \Delta t_0$ , it should similarly be both true that the speed of the body generates the time dilatation in the movement direction exactly as the time dilatation in a certain direction generates the speed of the body. It necessarily mean that time cannot be *scalar* but must be *oriented* in a tridimensional frame. If time were not three-dimensional the second interpretation of the link between speed and time dilatation would not be possible; in fact, without a direction identifying  $\Delta t$ , a temporal dilatation could not be associated with any specific vector velocity  $\mathbf{v}$ . Therefore the Reciprocity supports the recent space-time's six-dimensional hypothesis by the composition of both space and time three-dimensionality (cf. refs.[15-17],[22],[24]).

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