

International Conference on  
**ASTRONOMY, ASTROPHYSICS AND ASTROBIOLOGY**  
May 30-31, 2018 Osaka, Japan

**The trampoline model as a teaching analogy of the general theory of relativity**

Katsakoulas Ioannis<sup>1</sup>, Koinis Spyros<sup>1</sup>, Verouti Maro<sup>1</sup>, Liarakos Georgios<sup>2</sup>, Tsilalis Dimitrios<sup>3</sup>, Kollias Nikolaos<sup>3</sup>, Kalaitzidis Dimitrios<sup>4</sup>, Burns Daniel<sup>5</sup>

<sup>1</sup>National and Kapodistrian University of Athens, Greece

<sup>2</sup>Kaisariani 1<sup>st</sup> Lyceum, Greece

<sup>3</sup>Piraeus Ralleio Lyceum, Greece

<sup>4</sup>Neo Faliro gymnasium school, Greece

<sup>5</sup>Lawrence Livermore National Labs, Los Gatos high school

**Statement of the Problem:** The theory of relativity involves some most counterintuitive predictions calling for a teaching approach as much intuitive as possible. Simulations highly elaborated and accurate can be implemented by animated graphics, but these are not “palpable” analogies and they require a minimum familiarity with the mathematical formalism.

**Methodology & Theoretical Orientation:** The most accessible way to address most of the predictions by a natural means stands in the trampoline model. Our purpose was a qualitative approach to the predictions of the general theory of relativity for pupils who did not have prior contact with the subject in the frame of non formal or informal education. After the didactic transformation, our teaching involved introductory frontal delivery → disclosure of the lesson’s objectives to the learners → disclosure of the model’s weaknesses & check of the related misconceptions → Newton’s law of attraction → precession of perihelion → bending of light’s trajectory and redshift → black holes & dark energy → gravitational waves → frame-dragging’ and required familiarity with i) the Euclidean geometry, the concept ii) of fraction, iii) of friction, and iv) of kinetic energy.

**Findings:** a teaching tool handling all predictions of the theory was produced. Most of the secondary graders seemed able to grasp the fundamental concepts of the theory of relativity. The answer rates indicated acceptance and increased interest.

**Conclusion & Significance:** The qualitative knowledge of the theory of relativity does not exceed the zone of proximal development as carried out in this “one teaching hour” attempt. During answering, the pupils developed some pretty difficult questions of their own indicating that the teaching procedure points out to the right path. The trampoline model seems to play an essential role in the didactic transformation of the theory of relativity to the school science.

preeclampsia.forum@gmail.com

Notes: