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The Nature of Light: What are Photons? VI

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Introduction

First, we must thank our committee members and all the authors for their time and effort to make this 6th biennial conference a great success. It is the active efforts of many members to seek out new valuable contributors that adds to the quality and recognition of this "special" conference series through its sustained growth. Of course, we must also thank the SPIE staff, whose professionalism is of critical importance to get everything done correctly and on time, in spite of innumerable demands from authors and chairs for immediate action.

Before highlighting this year's conference (Section-3), let us briefly outline the program of our 6th biennial conference held in August of 2015, in San Diego. The year 2015 has also been declared as the "Year of Light" by the Executive Board of UNESCO http://www.prweb.com/releases/2012/10/prweb10054327.htm. We welcome this declaration and will play our part by promoting a deeper understanding of the nature of light that overcomes the philosophical and cultural prejudices that are holding back enlightened thinking and consequent progress in physics and society at large. Those who are interested in developing web-based dialogues with their colleagues and highlighting their own epistemology are welcomed to visit the website: http://www.natureoflight.org/. Here, the video of Professor Marlan Scully's talk, given during the 6th biennial conference, can be viewed.

1. Call for the 7th biennial conference

While we have stayed on course with the ontological question, "*What are photons?*" from the standpoint of foundational thinking, we are actively soliciting participation from all major fields of physics (classical optics, quantum optics, relativity, cosmology, etc.). The two worlds of electromagnetism and material particles are inseparably intertwined. This is quite obvious from electron-positron pair production out of gamma rays and production of gamma rays out of electron-positron collisions. Optical science and engineering will start thriving faster once we understand the deeper physics behind light-matter inter-convertibility. The expression "wave-particle-duality" and the related debate started more than 400 years ago with Newton and Huygens when this expression was understood as a lack of our understanding and raised deeper questions. Instead, over the last hundred years, our prevailing scientific culture has succeeded in elevating this lack of knowledge to a new knowledge! That is why the importance of this conference forum is timely, as is evidenced by the growing recognition of this conference series.

The significance of this forum also derives from historic pragmatic reality. Since ancient times, optical science and engineering have been providing us with key

enabling tools (both incisive thinking and precision measuring instruments) to advance broader science and technologies.

2. Brief history behind this conference series

This "special" conference series was first held in the opportune year of 2005 when the whole world was celebrating the centennial celebration of "Einstein's Miracle Year!" We have just finished the 6th biennial conference and have started planning for the 7th biennial conference to be held in August 2017. All of you are strongly urged to participate with your outside-the-box ideas. Please, start soliciting your colleagues to join us in 2017.

For this 2015 conference, in this printed volume, we are publishing 38 papers out of 47 presented, with an original submission of 59 papers. Hopefully, the digital volume to be published this November should contain all the presented papers. During 2013, for the 5th conference, we had 52 papers published out of 64 papers submitted. In 2011, for the 4th conference, we published 56 out of 63 accepted papers. In 2009, we published 30 papers. In 2007, we published 31 papers. In 2005, for the first conference, we published 34 papers. The sustained improvements in the quality and the quantity of papers indicate that we are definitely meeting an important need of our scientific and engineering community. The rate of engineering innovations in a field goes up when the deeper physical meaning behind the relevant phenomena becomes clearer and accessible to more engineers.

3. Brief summary of the content in this volume

The readers will find the papers in this volume roughly follow the sessions categorized below.

Monday, 10 August 2015
Session 1: Quantum Concepts/Epistemology I
Session 2: Quantum Concepts/Epistemology II

Tuesday, 11 August 2015
Session 3: What Is a Photon I
Session 4: What Is a Photon II
Session 5: Particle Wave Duality I
Session 6: Particle Wave Duality II

Technical Event: Tuesday Evening Keynote Talk by Prof. Marlan Scully: The Nature of Light: What are Photons? (To watch the video of this talk, go to: http://www.natureoflight.org/.)

Wednesday, 12 August 2015
Session 7: Space Medium/Non-Interaction of Waves I

Session 8: Space Medium/Non-Interaction of Waves II
Session 9: What Is a Photon III
Session 10: Space Medium/Non-Interaction of Waves III

Thursday, 13 August 2015
Session 11: Space Medium/Non-Interaction of Waves IV

Panel Discussion: Are Electrons Oscillating Photons, Oscillating "Vacuum," or Something Different?

The panel discussion this year was very productive and animated. The panel summary can be found in this volume (*Proceedings of SPIE* Vol. 9570-100). Please, feel free to suggest new concepts for panel discussions. You can submit your suggestion by joining the web-group at: http://www.natureoflight.org/. This will allow a head-start for your suggested concept.

The nature of photons has been a mystery for many centuries, and this conference deepens that mystery, albeit through enlightening newer ideas. Those who are looking for rational, logical, consistent descriptions of observable phenomena in terms of concepts such as photons, electrons, protons, neutrons etc., might find inspiration in the outside-the-box thinking that is presented in the papers of this volume. Some papers address quantum concepts from very different perspectives. For instance, one paper starts by asking how sense impressions relate probabilities, a product of human thought, and shows that this mental process leads to quantum theoretical description, whereas other papers start from the assumption that there is an underlying objective reality. Yet another paper analyzes the EPR experiment and concludes that photons are more likely to be a mental construct rather than an ontic entity. There are several papers that focus on the nature of the photon, providing a wide variety of novel and yet logical approaches to understanding what photons and electromagnetic waves might be. Some of these papers propose that both photons and particles be represented by harmonic oscillations, thereby avoiding the need to introduce the concept of wave-particle duality. The latter is itself the subject of several papers which suggest various alternative pictures to set up a logical, mystery-free description of experimentally observed phenomena. Several papers also challenge the fundamental hypotheses behind relativity and gravitation. The idea that space itself might be regarded as a (dynamical) medium is scrutinized in several papers, again from different viewpoints and with quite diverse approaches. Some of these papers point out that the role of the observer has not been incorporated properly in the special theory of relativity. Others show that an extension of relativity can encompass both the free-field Maxwell equation and the Dirac equation and/or discuss the structure/topology of the solutions of such extended equations.

The collection of papers and panel discussion in this volume clearly show that there is no indication that the foundation of physics is close to being finalized. Hence, we need your active participation to strengthen and broaden this outside-the-box platform to nurture inquiring minds set to explore the nature of light/matter and keep disseminating the new ideas freely expressed here.

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