ON THE IMPORTANCE OF SYMMETRY ON THE PHOTONIC ENVIRONMENT

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Abstract:
Consideration is given to the relevance of unitary symmetry in relation to the environment in which photonic research takes place. Both a U(1) and a SU(2) environment are considered and the results compared. It is found that there is a direct polarity between these two unitary symmetry groups with regard to both photonic behaviour and research results, such that it leads to the conclusion that environmental symmetry directly affects photonic activity and also research outcomes.

INTRODUCTION

J. Raftery and D. Sadri et.al. at Princeton University[1] have recently performed research using strongly correlated photons, in a an environment consisting of two microwave resonators, each coupled to a qubit called a transmon. Each qubit contains a superconducting Josephson junction that induces the current in a non-linear fashion. This nonlinearity of induction encourages the photons to strongly interact.

There is more detailed background information regarding this research,[2] but essentially what Raftery et. al have discovered is that by reducing the number of photons in the system to such a degree where the Josephson oscillation reaches the critical value of $g_c = 2.8JN^{1/2}$, there occurs a divergence in the periodicity of the oscillation such that the photons become trapped on one side and the symmetry of the oscillation is broken, thus causing a many body physics environment.

I believe that this research shows the genesis of creating anti-particles. I propose that the value of $g_c = 2.8JN^{1/2}$ is the critical point for phase transition, because this is the value of the mathematical constant of the Fransén–Robinson constant, which is the mathematical constant that represents the area between the graph of the reciprocal gamma function, 1/Γ(x), and the positive *x* axis (refer Figure 1 below):

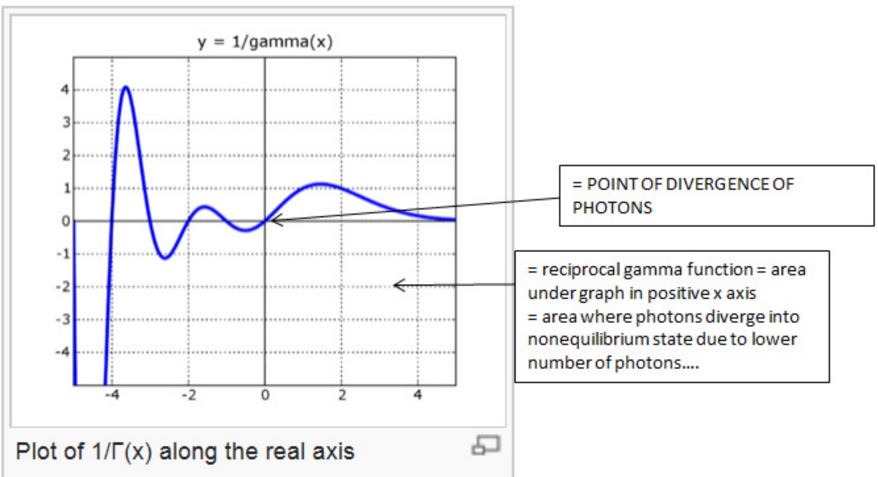

Figure 1 – Reciprocal gamma function

I propose that this segment of the graph is the region where antiparticles would be found and that it is precisely the U(1) environment of the photons themselves, as well as the U(1) environment afforded by the two microwave resonators that create a system that simulates the U(1) environment. It is this U(1) state that represents the quantum superposition state, which, when caused to collapse by the forced reduction in photon number, creates a simulated quantum collapse and there arises a many body physics environment.

Below is a diagram of the results of the Raftery et.al. research showing the area of photonic activity[3]:

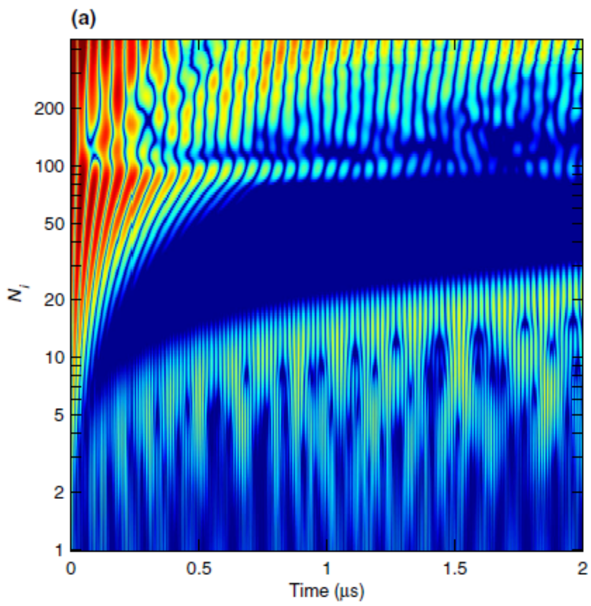

Figure 2 - Results of Raftery research

Note that the area of photonic activity in the above diagram is in the same region as the prescribed region of the reciprocal gamma function (Figure 1), which is the mathematical constant of 2.8, by taking the red area in Figure 2 to be the *y* axis.

I further propose that the opposite occurs in an SU(2) environment of a quadratically non-linear system, whereby the self-trapping occurs for a higher number of excitations.[4] Here is a comparative chart for this:

U(1) environment 2 microwave resonators -non-linear		**SU(2) environment quadratic non-linear**	
High photon activity	Classical behaviour	Low photon activity	Classical behaviour
Low photon activity	Self-trapping = asymmetry	High photon activity	Self-trapping = asymmetry
Function	reciprocal gamma	Function	gamma
Particles produced	anti-fermions	Particles produced	fermions

Thus it can be demonstrated that the determining factor in the differentiation of the two environments is one of symmetry, with the U(1) environment giving rise to many body physics in low excitation states and SU(2) in a high excitation environment.

This observation on environmental symmetry has implications for many areas of physics since it demonstrates the fact that the environment in which the excitations occur determines both the behaviour of the photons as well as the output of the dynamics. I venture to propose that the quadratic non-linear environment simulates the environment required for Lorentz transformations to occur – i.e. an SU(2) environment and further that this quadratic non-linear environment is the basis state for the quantum field that acts to produce particles via the gamma function.[5]

Further research is obviously required to determine the veracity of this heuristic viewpoint, but the fact remains that further research into environmental symmetry could well prove beneficial in determining both particle behaviour and the types of particles that arise as a result of the symmetry of the environment in which the quantum dynamic occurs.

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[1] http://journals.aps.org/prx/pdf/10.1103/PhysRevX.4.031043
[2] http://journals.aps.org/prx/abstract/10.1103/PhysRevX.4.031043#authors
[3] http://journals.aps.org/prx/pdf/10.1103/PhysRevX.4.031043
[4] http://journals.aps.org/prx/abstract/10.1103/PhysRevX.4.031043#authors
[5] *Principia Unitas – Volume IV – On the Origin of Quantum Mechanics – April 2013,* 978-0-9807766-6-9, P. 18