Generalized Quaternion Quantum Electrodynamics from Ginzburg-Landau-Schrödinger type Equation

(Proposed Research Abstract)

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Despite incomparable achievement of Quantum Electrodynamics and its subsequent theories, there are some known limitations and unsolved theoretical problems until this time, including 'renormalization' condition [1][2] and its generalization to larger systems. While renormalization problem has been declared as 'settled', yet it is known for their own founding fathers (Feynman & Dirac, for instance) this question remains unsolved satisfactorily. Other known problems include limitation to explain anti-hydrogen phenomena [5][39], and confinement problem in quantum chromodynamics theory.

In the meantime, electrodynamics theories have advanced beyond established stage and it has become possible to extend these theories to include self-similarity (scale-invariance). There are also some recent interests to re-consider quaternion and biquaternion numbers in describing electrodynamics phenomena in original form as conceived by Maxwell.

For generalised case, it could also be expected that by using quaternion numbers we could also achieve scale-invariant quantum electrodynamics, which could yield explanation for quantization of celestial systems [3], which have been observed in recent years. For these known reasons, the sought-after theory will be called here: Generalized Quaternion Quantum Electrodynamics from Ginzburg-Landau-Schrödinger type equation, or for simple term (GQQED). It is expected that by the end of tenureship, the basic principles of this sought-after new theory could have been formulated and presented in understandable way.

1 Research description

Despite incomparable achievement of Quantum Electrodynamics and its subsequent theories, there are some known limitations and unsolved theoretical problems until this time, including 'renormalization' condition [1][2] and QED generalization to larger systems. Other known problems include limitation to explain anti-hydrogen phenomena, and confinement problem in quantum chromodynamics theory.

In the meantime, there are some recent interests to re-consider quaternion and biquaternion numbers [2][6][7][9] for describing electrodynamics phenomena in original form as conceived by Maxwell. Therefore, it seems possible to generalize this new approach to use quaternion/biquaternion number towards a new Quaternionic Quantum Electrodynamics theory, which is free from renormalization problem. It appears that the new theory should be consistent with topological electronic interpretation of QED [10][23][27][28][30], which could also arrive at the same Bohr-type quantization condition for large-scale systems [28].

The research will be conducted in a few steps as follows:

a. literature survey: examine historical development on the use of quaternion/biquaternion numbers in QED;
b. theoretical development: algebraic structures of quaternion/biquaternion numbers & interpretation;
c. derive implications of the theory: derive implications of the proposed theory and to find physical phenomena corresponding to the theory. This step includes making quantitative prediction;
d. data collection: collect quantitative data from astrophysical observation etc.
e. comparison: compare observed data and theory;
f. experiment: develop method to verify theory for practical purposes, for instance using scale-invariant

quantum electrodynamics theory to build better antenna systems.

Methodology to be used in this proposed research is 50% pure theoretical investigation, 30% data collection and analysis, and 20% experimental work.

2 Significance of the proposed research

In recent years, there are numerous exoplanet observations [11][12][13], which could be predicted via Bohr-type quantization condition with a remarkable precision [14][15].

An alternative method to describe this quantization of celestial system is by generalizing quantum electrodynamics. It is known that quantum electrodynamics (QED) is one of the most profound discoveries in the past century, but it has not been used to describe classical-celestial systems.

By generalizing quantum electrodynamics, the proposed research could open a new way of thinking the nature of astroparticle physics field.

3 How an Institution could contribute

The Institution should be well known for its high reputation in frontier research in various fields, including astrophysics. Therefore the applicants believe that there are numerous previous observation data which could be collected and re-organized in much more meaningful way, provided the new hypothesis is available (including perhaps exoplanets data, planetary migration, planetary precession, etc.).

In the meantime, there should be senior fellows in the Institution who also work in areas related to planetary formation and migration, which perhaps could contribute to the research to be conducted herein.

4 Possible Research Advisors

From the list of Smithsonian Institution scholars, there are some scholars, who perhaps would like to be research advisor for this proposed research:

- K. Kirby (Bose-Einstein condensate and astroparticle)
- Rudolph E Schild (Navier-Stokes and cosmology)
- Charles J. Lada (star & planet formation)

For co-advisor / consultant, the applicant has identified a few scholars:

- Robert P. Kirshner (accelerating universe hypothesis)
- Willie Soon (Earth and planetary studies)
- L. Hartmann (senior astrophysicist / lecturer)

Nonetheless, along the way of this research, the authors would like to consider numerous discussions with other research fellows within or outside the Smithsonian Institute, in particular those who have conducted previous experimental/theoretical works in the similar line of research (i.e. new advancement of QED theories).

5 Estimate of time period: 12 (twelve) months (max.).

6 Estimated budget (research allowance)

While the majority of activities only include mathematical/theoretical development, by the end of tenureship we expect to build example of practical tool, which could serve as ‘model’ where the proposed theory could play a role. For instance, the applicants expect to develop a new method of antennae design for electronic transmitter or wireless communication.

To build such a practical tool, it is required to purchase raw material and toolkit. We expect to build four or five antenna designs as an alternative of present design (with various scales from small-scale to full-scale antenna). List of tool expected is described in section #7.

The estimated budget is around $4,000 (for four – five antenna designs), unless these tools could be found in lab without necessarily purchasing them.

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7. List of toolkit expected:

The present estimate to conduct experiment includes:

- one (1) Weller soldering iron by Cooper Tools;
- one (1) mini tubing cutter;
- one (1) mini drilling tool;
- one (1) handheld dril;
- electric rod;
- electric Copper wire;
- stainless steel plate (2 mm);
- N Connector;
- RF Connector;
- Multitester.

Other tools/materials as per need.

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