Contribution ID: **76** Type: **Oral Presentation**

Bilinear expansion of the photon quantum field and the emergence of classical mechanics from quantum field theory

Friday, 15 July 2011 08:00 (30 minutes)

<p>The electro-magnetic field is expanded in a bilinear series consisting of products of quark creation and annihilation operators. This bilinear form is suggested by the equations of motion for the electromagnetic field and provides a very powerful quantum representation, which is devoid of many of the technical problems associated with standard quantization. In this approach the energy of the physical photon can be expressed as an expectation value of the energy-momentum tensor. The direct term already yields the correct result, so one has to eliminate the additional cross term to maintain this correct result. In order to affect this elimination one needs to introduce a continuous set of "hidden" quantum numbers, which can be related to the classical positional coordinate of the particle. These "big bang variables" are introduced as state labels, just like the momentum variable. The quantum amplitudes are insensitive to the choice of these coordinates, so that the introduction of classical coordinates does not conflict with standard quantum field theory calculations or with the Heisenberg uncertainty principle. However, in a many-body system coherence make these coordinates emerge as the relative classical coordinates. Hence, classical mechanics emerges naturally from many-body quantum field theory. Without violating quantum mechanics, particles can thus be specified in terms of momentum and position, in clear analogy to classical physics and statistical mechanics. Composite particle systems are then identified by having identical classical coordinate labels, while independent particles have distinct labels and are not subject to the Pauli principle in the remaining variables.

Level (Hons, MSc,
   PhD, other)?

PhD

Consider for a student
   award (Yes / No)?

No

Would you like to
 submit a short paper
 for the Conference
 Proceedings (Yes / No)?

Yes

Primary author: Dr GREBEN, Jan (CSIR)

Presenter: Dr GREBEN, Jan (CSIR)

Session Classification: Theoretical

Track Classification: Track G - Theoretical and Computational Physics