Re: The time it takes to emit one photon

Source: http://sci.tech−archive.net/Archive/sci.physics.research/2005−08/msg00407.html

- *From*: Igor Khavkine <igor.kh@xxxxxxxxx>
- *Date*: Fri, 19 Aug 2005 05:47:06 +0000 (UTC)

In article <43051258.2060601@xxxxxxxxxxxx>, Eugene Stefanovich wrote:
>
>
> Igor Khavkine wrote:
>
>> First, let me say how I see the connection between non−linear classical
>> field theory, QFT, many particle quantum mechanics, and classical
>> particle mechanics.
>>
>> Quantization
>> Classical Field Theory <−−−−−−−−−−−−−−−−> QFT
>> Classical Limit ^
>> |
>> Fock Space |
>> Construction | Wave Function
>> | Representation
>> Classical Quantization V
>> Particle Mechanics <−−−−−−−−−−−−−−−−> Many Particle QM
>> Classical Limit
>>
> Dear Igor,
>
> I don't have much hope that you'll accept my position, because
> it flies in the face of everything you've learned at school.

I have many problems with your position, but that is not one of them.

> I would like to modify your diagram in the following way:
>
> Classical Quantization
> Particle Mechanics <−−−−−−−−−−−−−−−−> Variable # of Particles QM
> Classical Limit
>
> You may note that I dropped QFT from that picture. In my view,
> QFT is not a complete physical theory. It becomes complete only
> after making the unitary transformation to dressed particles.
> This transforms QED to the relativistic QM formulated in the Fock space
> (i.e., with variable number of particles) and, incidentally,
> removes all QFT problems related to infinities and bare particles.

Whatever your opinion of QFT, it is equivalent to a quantum theory of a variable number of particles. You are free not to make use of this mathematical equivalence, I myself and many others choose to use it.

Moreover, your diagram is incomplete. Particle mechanics is the classical limit of a quantum theory with a fixed number of particles. I explained this in the paragraphs below the diagram in my previous post. When you allow the number of particles to vary (use Fock space), strictly speaking you have a different quantum theory. This different quantum theory also has a different clasical limit, which happens to be a field theory.

> There is no classical field theory on my picture as well.

It's always there. All you've said is that you choose not to use it.

> For example, I would place Maxwell's theory somewhere between
> QM and classical particle mechanics. In my view, Maxwell's theory
> is a partial classical limit of QM in which heavy particles
> (e.g., electrons) are treated classically, but the treatment of
> photons remains quantum.

There is no need to place anything half way between quantum and classical. Maxwell theory is purely classical. Photon number is not conserved. So, as per above, the classical limit of the photon sector is a field theory. Strictly speaking, electron number is not conserved either, but under low energy conditions the approximation that it is can be made. Moreover, electrons are massive and hence localizable. Therefore the clasical limit of the electron sector is a particle theory.

It is true that the single photon wave function and the photon sector field theory agree on their linear parts (Maxwell's equations). But this is true by construction, and no longer holds when more than one photon is present.

> The electric and magnetic
> fields in Maxwell's theory are just attempts to describe wave
> functions of (a very large number of) photons.

True. Large number of photons => hbar −> 0 => Maxwell field theory.

> In the presence of
> charged particles, these fields also incorporate instantaneous
> interparticle potentials (e.g., the Coulomb potential).

Only in special choices of gauge. Can of worms. I suggest not opening it until the Poincare noninvariance "proof" thread is exhausted. My last post to that thread is stuck somewhere in the moderation queue.

Igor
.

- ***Follow−Ups***:
  - ***Re: The time it takes to emit one photon***
    - ◊ *From:* Eugene Stefanovich

- ***References***:
  - ***Re: The time it takes to emit one photon***
    - ◊ *From:* nightlight
  - ***Re: The time it takes to emit one photon***
    - ◊ *From:* Eugene Stefanovich
  - ***Re: The time it takes to emit one photon***
    - ◊ *From:* nightlight
  - ***Re: The time it takes to emit one photon***
    - ◊ *From:* Igor Khavkine
  - ***Re: The time it takes to emit one photon***
    - ◊ *From:* Eugene Stefanovich

- Prev by Date: ***Re: Quantum Function of Mirrors***
- Next by Date: ***Re: Where can I find a catalogue of (d,p) cross sections?***
- Previous by thread: ***Re: The time it takes to emit one photon***
- Next by thread: ***Re: The time it takes to emit one photon***
- Index(es):
  - ***Date***
  - ***Thread***