



SDI FINAL EVALUATION FORM 1.1

PART 1:

Journal Name:	Physical Review & Research International
Manuscript Number:	2013_PRR1_6994
Title of the Manuscript:	Two-Body Dirac Theory

PART 2:

FINAL EVALUATOR'S comments on revised paper (if any)	Authors' response to final evaluator's comments
The Zitterbewegung is more of a relic of the early Dirac equation days. It does not exist in the standard position, velocity and acceleration operators of the single particle field, only in alternatively derived versions like in this manuscript. Zitterbewegung is due to the "small components" of the dirac 4-spinor (the last two components in a Dirac rep. where gamma-0 is diagonal) oscillating with a frequency $2mc^2$, which is entirely due to the little bit of antiparticle mixed up in the particle wavefunction for a nonrelativistic motion. It doesn't appear in the correct second quantized theory, or rather, it is resolved by using Feynman propagators and doing QED. Nevertheless, it is an interesting way to understand certain QED effects heuristically. This behavior of the propagator is easy to understand in the modern chiral representation and the propagator of the field. In principle all fields are massless and propagate with c. Due to coupling however propagators can have any speed between $+c$ and $-c$. The electron has two such massless components, $\psi = (\psi_L, \psi_R)$. So, you see the ψ_L and ψ_R alternating but is there a zitterbewegung of ψ or the individual components ψ_L and ψ_R? The answer is: NO for electrons and NO for positrons. This is because these are exactly the only two solutions of the Dirac equation which do not show a zitterbewegung. The reason for this is. electron at rest: $\psi_L = +\psi_R$ positron at rest: $\psi_L = -\psi_R$ The other "exotic" states where $\psi_L \neq \pm\psi_R$ at rest do show a zitterbewegung, for instance $\psi_L = i\psi_R$ or $\psi_L = \sigma_z\psi_R$. This is actually the reason why these states are not allowed. They would radiate away electromagnetic energy with the frequency corresponding to their mass. Here are some observation of zitterbewegung. Direct observation of zitterbewegung in a Bose-Einstein condensate arXiv:1303.0914v2 [cond-mat.quant-gas] 4 Jul 2013 In this work is shown, though the oscillatory motion's large frequency and small amplitude have precluded its measurement with electrons, zitterbewegung is observable via quantum simulation. Comments: Fig. 5 contains missprint in X-axis (0.00, 0.01, 0.01, 0.02,) (numbers 0.01, 0.01 are same). Also, where is the origin? The same is in Fig 6. Author has shown a new derivation of Dirac's equation as the scalar product of the electron's 4-momentum and an electromagnetic 4-potential postulated for the electron. There are other new ideas. This work can be published.	

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