



SDI Review Form 1.6

Journal Name:	British Journal of Mathematics & Computer Science
Manuscript Number:	Ms_BJMCS_27414
Title of the Manuscript:	Unique Structure of Free Particle Bound States
Type of the Article	Original Research Article

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PART 1: Review Comments

	Reviewer's comment	Author's comment (if agreed with reviewer, correct the manuscript and highlight that part in the manuscript. It is mandatory that authors should write his/her feedback here)
<u>Compulsory</u> REVISION comments		
<u>Minor</u> REVISION comments		
<u>Optional/General</u> comments	This paper seems to me quite unclear and does not sound physically correct. The main problem is with equation (1) in which the Lagrangian contains third order derivatives. This does lead to unphysical negative energy solutions, which boundary conditions cannot correct. There are other problems in the paper. I wish to mention some of them (not all): 1) The sentence in page 2 containing "... but to respect momentum conservation the momentum of the participating particles (fermions or more complex objects composed of hadrons and/or leptons) has to be counterbalanced by neutral particles (bosons or neutrons), ..." is quite bizarre. If the meaning is "fermions must be bounded with bosons", this is not true. One can think about the hydrogen atom. If the meaning is "bosons are gauge particles", the example "neutron" is not correct. 2) In page 4, the Fourier transform is used to pass from q-space to r-space. But what becomes of the angular momentum? Only radial variables appear in the following. A mention about angular momentum appears suddenly a page later. 3) In page 6, it is mentioned that experimental data of very different systems are well described with only 3 parameters. What about other particles? Is it necessary to adjust 3 values for each case?	To his first remark: The gauge invariant Lagrangian has definitively the right structure to describe free particle bound states: the binding energy has to be negative for a bound state, but the total energy and particularly the mass is positive, in agreement with the hadron mass (for atoms the (negative) binding energies are consistent with the data). To 1) This point is very important and gives rise to the special form of the Lagrangian. It states that the binding of fermions is not sufficient to describe free particle bound states, accompanied boson fields (not only a boson-exchange interaction) are essential to equilibrate the momentum of the fermions. In this way a bound state description is obtained, in which 10 boundary conditions have to be satisfied with three parameters only. To 2) Angular momentum is related to the total spin of the particles. In the present manuscript we concentrate on angular momentum $L=0$, that means essentially isotropic angular structure. To 3) In principle yes. The slope parameter b gives the particle mass, which varies for different systems. The shape parameter η



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	To finish, I wish to mention that the well confirmed phenomena of asymptotic freedom and confinement in QCD need a non-abelian Lagrangian. There is no mention about that in a paper whose claim is to describe also hadronic physics.	should not change much, but the coupling constant could be different for hadrons and atoms, but unchanged for hadrons or atoms. However, the fact that in the whole formalism no external parameters are needed, suggests strongly that the present formalism is fundamental with a universal coupling constant for all systems. This seems to be the case but has to be confirmed in further studies. To his final comment: Indeed, I did not discuss QCD, which does not provide an explicit description of hadrons, but rather an “effective” description of the strong interaction with external parameters, elementary fermion masses, coupling constant and mixing to noncolored fields. In the new manuscript a short discussion of the relation to QCD is included.
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