Mathematical Physics

Ground states of semi-relativistic Pauli-Fierz and no-pair Hamiltonians in QED at critical Coulomb coupling

Martin Könenberg, Oliver Matte

(Submitted on 7 Jun 2011 (v1), last revised 16 Apr 2012 (this version, v2))

We consider the semi-relativistic Pauli-Fierz Hamiltonian and a no-pair model of a hydrogen-like atom interacting with a quantized photon field at the respective critical values of the Coulomb coupling constant. For arbitrary values of the fine-structure constant and the ultra-violet cutoff, we prove the existence of normalizable ground states of the atomic system in both models. This complements earlier results on the existence of ground states in (semi-) relativistic models of quantum electrodynamics at sub-critical coupling by E. Stockmeyer and the present authors. Technically, the main new achievement is an improved estimate on the spatial exponential localization of low-lying spectral subspaces yielding uniform bounds at large Coulomb coupling constants. In the semi-relativistic Pauli-Fierz model our exponential decay rate given in terms of the binding energy reduces to the one known from the electronic model when the radiation field is turned off. In particular, an increase of the binding energy due to the radiation field is shown to improve the localization of ground states.

Comments:	Revised second version providing optimized exponential decay rates for the semi-relativistic Pauli-Fierz model; see Theorem 4.5 and Remark 4.7. The revised manuscript is accepted for publication in the Journal of Operator Theory. 25 pages
Subjects:	**Mathematical Physics (math-ph)**
MSC classes:	81Q10, 47B25
Cite as:	**arXiv:1106.1393 [math-ph]**
	(or **arXiv:1106.1393v2 [math-ph]** for this version)

Submission history

From: Oliver Matte [view email]
[v1] Tue, 7 Jun 2011 16:44:06 GMT (23kb)
[v2] Mon, 16 Apr 2012 19:43:03 GMT (28kb)

Which authors of this paper are endorsers?