

Response to the Comment by Grotch and Kazes

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We reply to the criticisms made in the preceding Comment.

Grotch and Kazes¹ correctly point out several deficiencies in our recent low-energy single-particle calculation² of $g - 2$ for the electron. Our estimation of these deficiencies is somewhat different from theirs.

It is obvious that any non-field-theoretical calculation of $g - 2$ must be a model calculation, and that the deviations of the model from full quantum field theory will lead to deficiencies in the results.

Concerning the deficiencies of our model, Grotch and Kazes note that they are of two kinds. In the first place, with our sign operator (inserted to simulate the Pauli principle in a one-particle theory) the model fails to describe Compton scattering; the free-electron self-energy does not agree completely with field theory³; and the model is not charge-conjugation invariant.

We have found⁴ a simpler way, than the sign operator, to put the effects of the negative-energy sea in the model, and the resultant improved model is actually free of these three deficiencies. From our point of view it is important that the improved model still allows the same kind of calculation of $g - 2$ to be made, and the qualitative separation of the main contributions into a part arising from the charge interaction and a part arising from the spin interaction is still valid. The improved model, however, gives a result for $g - 2$ that is negative and not sensitive to cut-off.

We agree with Grotch and Kazes that a more serious deficiency is our unjustified treatment of self-masses and mass shifts. This is a very difficult subject in single-electron theory, and doubtless will be further investigated. However, the remarks of Grotch and Kazes, and the results of our improved model, now make it apparent to us that electrostatic and renormalization effects are features equally important to the problem as those features we discussed. These effects go beyond the cancelation of certain self-masses in our calculation.

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¹H. Grotch and E. Kazes, preceding Comment [Phys. Rev. Lett. **35**, 124 (1975)].

²S. B. Lai, P. L. Knight, and J. H. Eberly, Phys. Rev. Lett. **32**, 494 (1974); S. B. Lai, P. L. Knight, and J. H. Eberly, to be published.

³The sign operator prescription gives the electric field part and the magnetic field part of the W_{sp} term of Weisskopf [Phys. Rev. **56**, 72 (1939)] correct to the leading divergent terms and in the correct signs. However, the W_{fluct} term becomes omitted. Thus the free-electron self-energy expression according to the sign-operator prescription differs from the field-theory expression.

⁴S. B. Lai, P. L. Knight, and J. H. Eberly, unpublished.