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Quantum electromagnetic nonlinearity affecting charges and dipole moments

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Owing to the virtual electron-positron pair creation, quantum electrodynamics (QED) may be effectively treated as a nonlinear classical theory of electromagnetic fields. The corresponding mutual and self- interaction of electromagnetic fields is important where these are as strong as magnetic fields of magnetars, electric fields of quark stars, and fields in close vicinity of elementary particles generated by their charges and/or electric and magnetic dipole moments.
We claim that the electromagnetic self-coupling of the dipole moments makes it necessary to subject their values to a sort of renormalization after being calculated following one or another method of strong interaction theory, say QCD or lattice approach. This correction is estimated to be at the brink of the present-day experimental possibilities.
We also report on two magneto-electric effects of nonlinearity. The first is that the nonlinear response of the vacuum with a strong constant magnetic field in it to an applied Coulomb field of an electric monopole turns it into magnetic dipole in QED and into magnetic monopole in a theory with violated parity, the Coulomb field itself certainly undergoing a correction, too. The second is that if there are two, mutually non-orthogonal, strong constant fields in the vacuum, electric and magnetic, then already in QED an electric charge produces magnetic monopole field.
We also state that a point electric charge possesses a finite electrostatic self-energy due to the self-interaction, if its field is treated within classical electrodynamics nonlinearly extrapolated to its close neighborhood via quantum QED corrections.

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