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Nonlinear Electromagnetic Force Near Compact Stellar Objects[1]
LANCE LABUN, JOHANN RAFELSKI, University of Arizona — Quantum electrodynamics generates a nonlinear theory of electromagnetism from fluctuations of electron-positron pairs. The nonlinear interactions are suppressed by the field scale $B_c = m_e^2/e = 4.1 \times 10^9$ T. Fields approaching this magnitude are thought to be found only in the neighbourhood of strongly-magnetized compact stars, and in these environs the consequences of the nonlinearity are comparable to the effects of gravity. We derive the effective force on a charged particle entering a strong stellar magnetic field. The results show that the nonlinearity of electromagnetism affects the dynamics of plasmas near a compact star even when the stellar magnetic field is well below critical magnitude B_c.

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