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Time variation of the fine structure constant α from realistic models of Oklo reactors.[1] C.R. GOULD, NC State U and TUNL, E.I. SHARAPOV, JINR, Dubna, S.K. LAMOREAUX, Yale U — The topic of whether the fundamental constants of nature vary with time has been a subject of great interest since Dirac originally proposed the possibility that $G_N \sim 1/t_{universe}$. Recent observations of absorption spectra lines from distant quasars appeared to indicate a possible increase in the fine structure constant α over ten billion years. Contrarily, analyses of the time evolution of α from Oklo natural nuclear reactor data have yielded inconsistent results, some indicating a decrease over two billion years while others indicated no change. We have used known Oklo reactor epithermal spectral indices as criteria for selecting realistic reactor models. Reactors RZ2 and RZ10 were modeled with MCNP and the resulting neutron spectra were used to calculate the change in the ^{149}Sm capture cross section as a function of a possible shift in the energy of the 97.3-meV resonance. Our study resolves the contradictory situation with previous Oklo α-results. Our suggested 2σ bound on a possible time variation of α over two billion years is stringent: $-0.11 \leq \frac{\Delta\alpha}{\alpha} \leq 0.24$, in units of 10^{-7}, but model dependent in that it assumes only α has varied over time.

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