

# Constraining the cosmological time variation of the fine - structure constant

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Abstract: The variation of the fine-structure constant  $\alpha = e^2 / 4\pi\epsilon_0 \hbar c$  can be probed by comparing the wavelength of atomic transitions from the redshift of quasars in the Universe and laboratory over cosmological time scales  $t \sim 10^{10}$  yr. After a careful selection of pairs of lines, the Thong method with a derived analytical expression for the error analysis was applied to compute the  $\alpha$  variation. We report a new constraint on the variation of the fine-structure constant based on the analysis of the C<sub>IV</sub>, N<sub>V</sub>, Mg<sub>II</sub>, Al<sub>III</sub>, and Si<sub>IV</sub> doublet absorption lines. The weighted mean value of the variation in  $\alpha$  derived from our analysis over the redshift range  $0.4939 \leq z \leq 3.7$  is  $(0.09 \pm 0.07) \times 10^{-5}$ . This result is three orders of magnitude better than the results obtained by earlier analysis of the same data on the constraint on  $\Delta\alpha/\alpha$ . © 2010 Springer Science+Business Media, Inc.

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