Search for time variation of the fine-structure constant using [O_{III}] emission lines

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Abstract: A possible spatial and temporal dependence of the fine-structure constant $\alpha=e^2/(4\pi\varepsilon_0 c)$ was investigated. For this purpose, a statistical analysis of fine splitting of [O_{III}] doublet emission lines in SDSS (Sloan Digital Sky Survey) quasar spectra is carried out in order to estimate a possible time variation of the fine-structure constant (α) over cosmological time scales t10^{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 α variation. We report a new constraint on the variation of the α based on the analysis of 42 [O_{III}] doublets selected from SDSS quasar sample. We find $\Delta\alpha/\alpha=(-0.52\pm0.77)\times10^{-5}$ over a redshift range $0.16\leq z\leq0.80$. This result represents a factor of 14 improvements on the constraint on $\Delta\alpha/\alpha$ based on [O_{III}] doublets compared to the published results in the literature.
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