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Astrophysical evidences for the variation of fundamental constants and proposals of laboratory tests

Wednesday, 20 June 2012 14:30 (30 minutes)

There are new results for the variation of the fine structure constant alpha based on the quasar absorption spectra data. These results indicate the variation of alpha in space [1]. The spatial variation can explain fine tuning of the fundamental constants which allows humans (and any life) to appear. We appeared in the area of the Universe where the values of the fundamental constants are consistent with our existence. There is an agreement between the results obtained using different telescopes and different redshifts. Also, now there are no contradiactions between the results obtained by different groups. These astrophysical results may be used to predict the variation effects for atomic clocks which are very small and require improvement of the sensitivity by 1-2 orders of magnitude. This improvement may be achieved using 229Th nuclear clocks where the effect of the variation is hugely enhanced. There are also enhanced effects in multiply charged ions [2], and certain atomic and molecular transitions.
I may also present new results on parity and time reversal (EDM) violation in atoms
and molecules, and role of the W,Z,top-quark bags in bariogenesis [3].

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[1] J.K. Webb, J.A. King, M.T. Murphy, V.V. Flambaum, R.F. Carswell, M.B. Bainbridge, Phys. Rev. Lett. 107 (2011) 191101. J. A. King et al., accepted to MNRAS.
[2] J. C. Berengut, V. A. Dzuba and V. V. Flambaum,Phys. Rev. Lett. 105 (2010) 120801; Phys. Rev. Lett. 106 (2011) 210802.
[3] V. V. Flambaum, E. Shuryak, Phys. Rev. D82, 073019 (2010).

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