

Probing cosmological variation of fundamental physical constants by means of quasar absorption spectra

$$\frac{\delta(m/\Lambda_{QCD})}{(m/\Lambda_{QCD})} \sim 35 \frac{\delta\alpha}{\alpha}$$

(Flambaum2006)

Model dependent, variations of quark mass m_q and electron mass m_e (related to variation of the Higgs vacuum field).

Martin Wendt

Hamburger Sternwarte, C4, Prof. Reimers

SFB 2010, 30.06., Martin Wendt

Quick history

Q0347-383 has been on trial for numerous $\Delta\mu/\mu$ measurements mainly based on UVES observations in 2002.

Often in combination with Q0405-443.
Results ranging from:

$$\Delta\mu/\mu = (20 \pm 6) \times 10^{-6} \text{ (Reinhold et al. 2006) to}$$
$$\Delta\mu/\mu = (-28 \pm 16) \times 10^{-6} \text{ (Thompson et al. 2009).}$$

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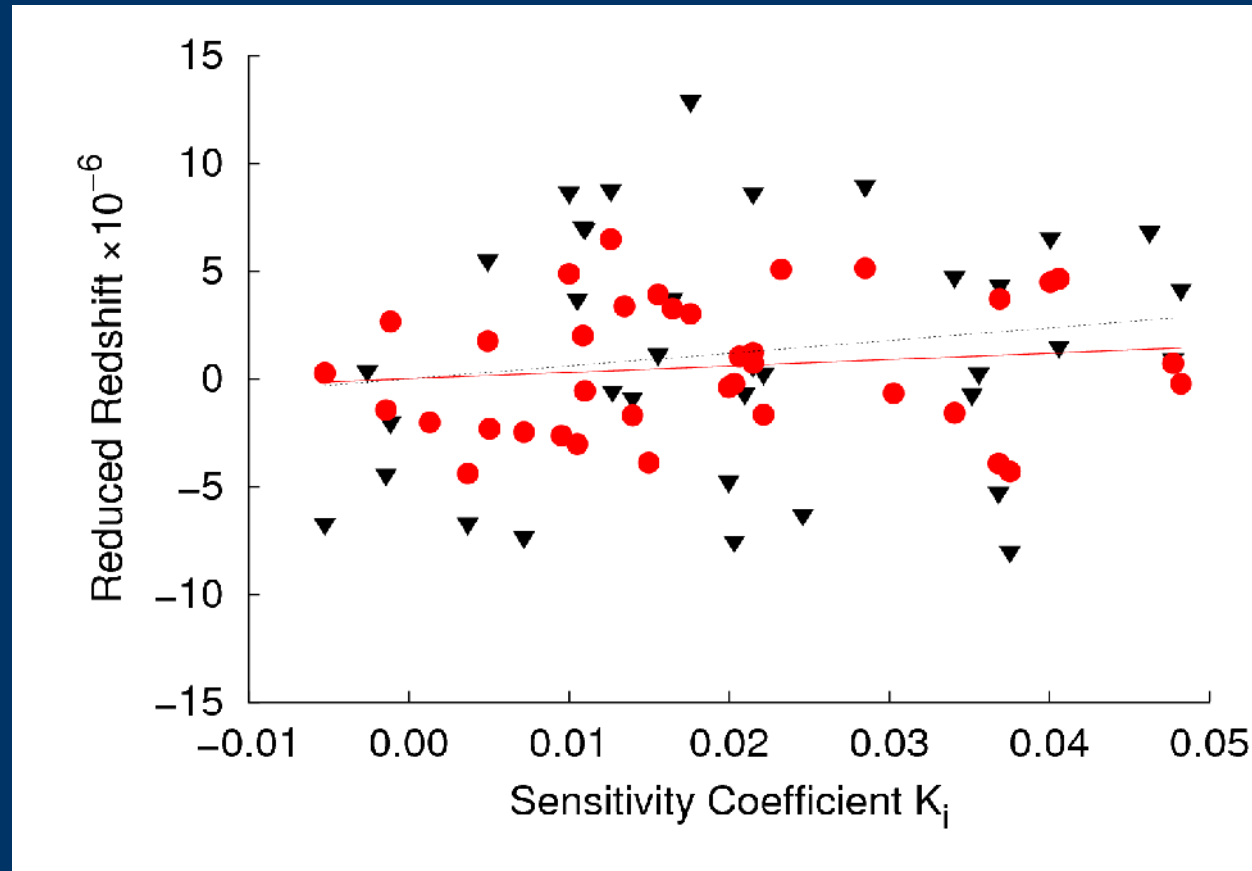
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New data in 2009 for Q0347:

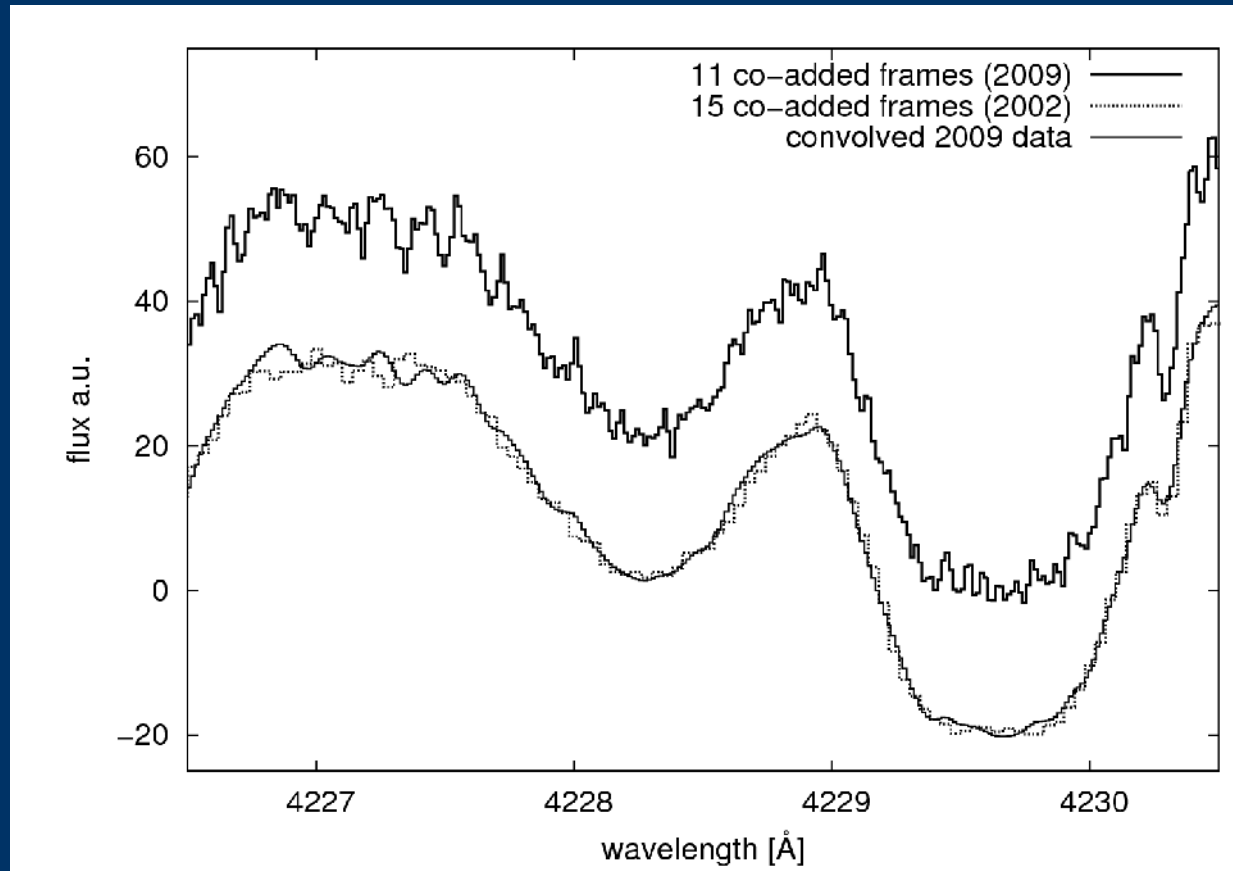
$$\Delta\mu/\mu = (2.9 \pm 8) \times 10^{-6} \text{ (Wendt & Molaro 2010).}$$

New observations with high resolution and refined methods



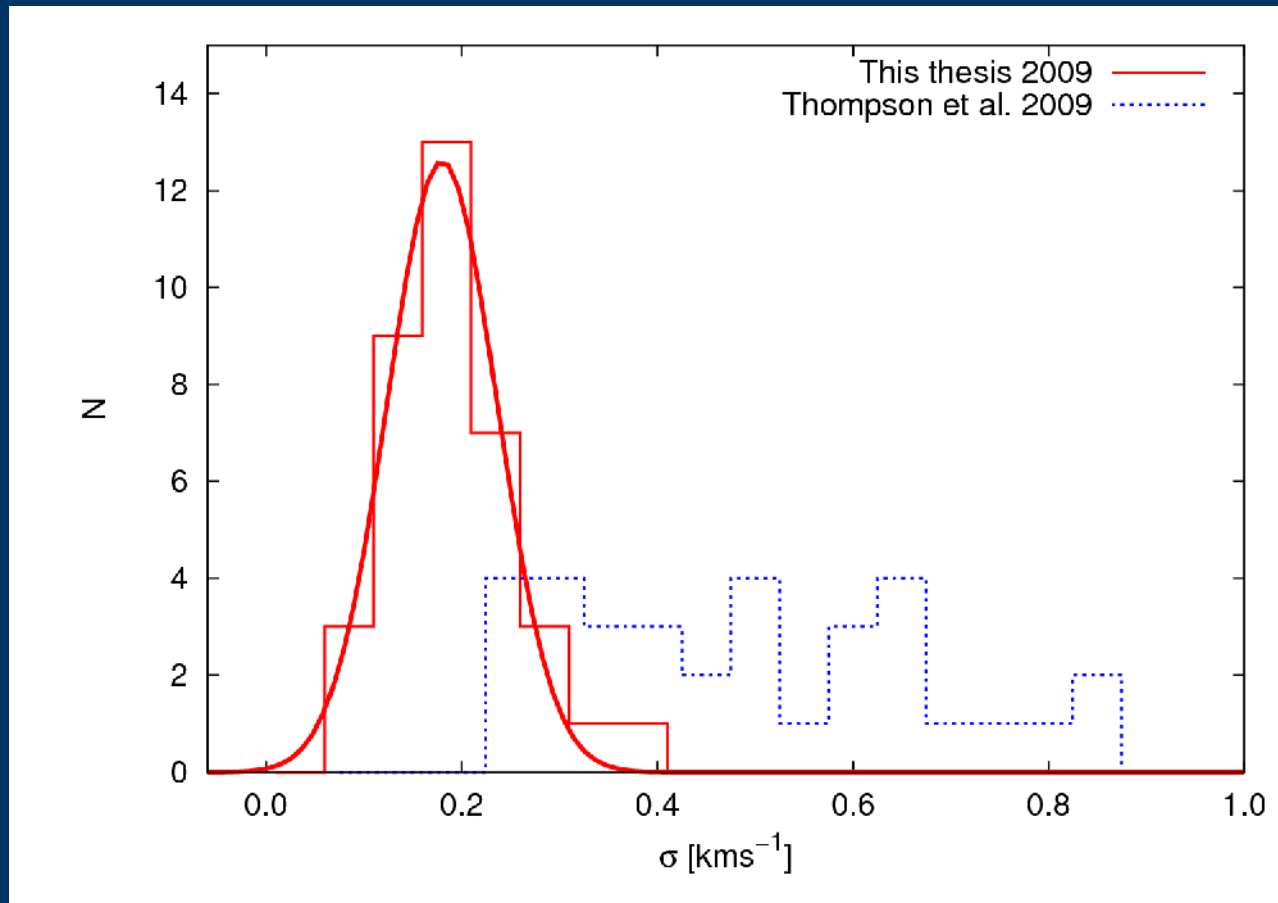
Result based on test-run data of the ESO Large Program

New observations with high resolution and refined methods



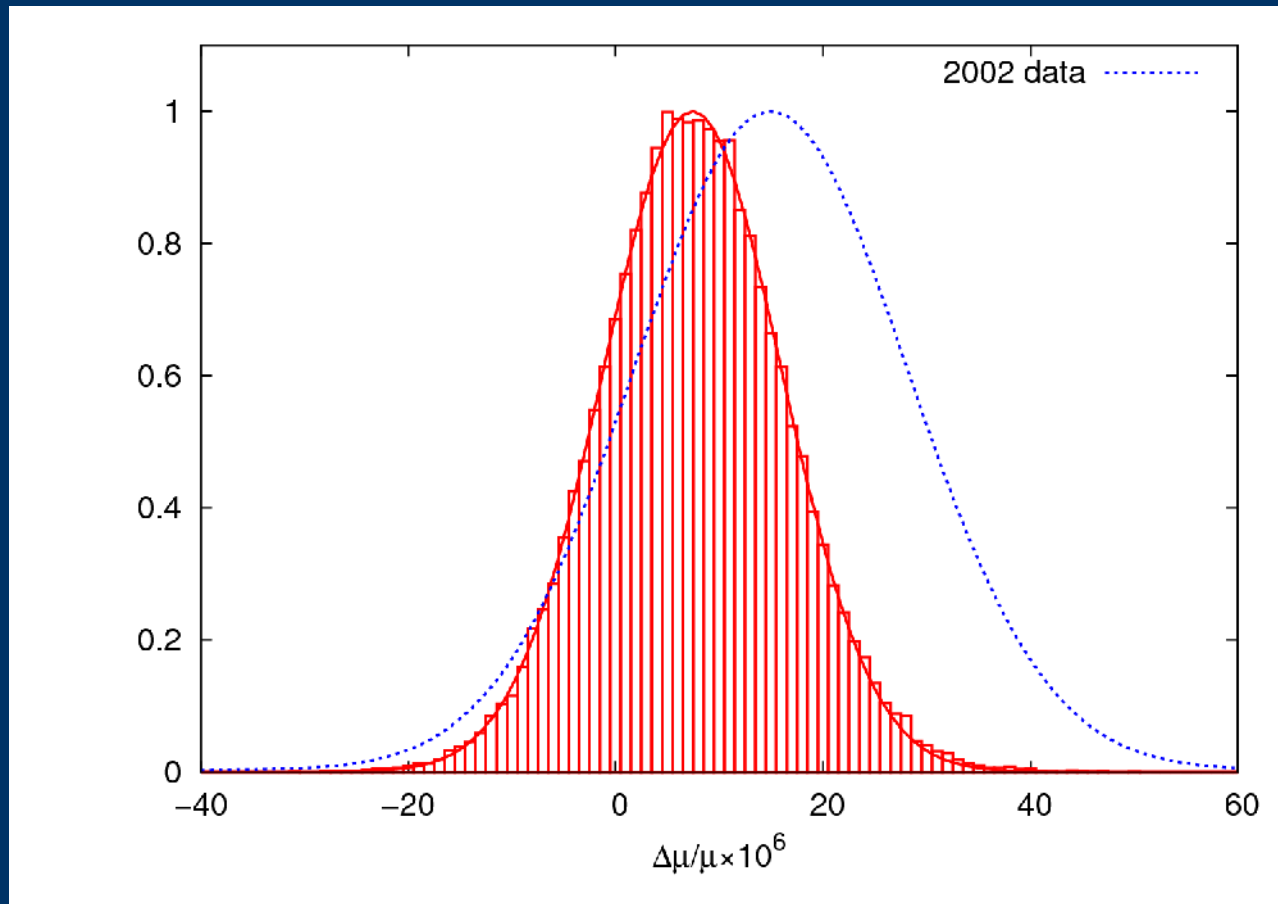
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New observations with high resolution and refined methods

accuracy of ≈ 2 ppm for each system (and ≈ 0.5 ppm for the mean of a sample with 22 systems) is within reach. Proprietary data rights are reduced to 6 months.

3. Run	Period	Instrument	Time	Month	Moon	Seeing	Sky Trans.	Obs.Mode
A	83	UVES	4n	jun	n	$\leq 0.8''$	CLR	v
B	83	UVES	4n	sep	n	$\leq 0.8''$	CLR	v
C	84	UVES	4n	nov	n	$\leq 0.8''$	CLR	v
D	84	UVES	4n	mar	n	$\leq 0.8''$	CLR	v
E	85	UVES	4n	apr	n	$\leq 0.8''$	CLR	v
F	85	UVES	4n	sep	n	$\leq 0.8''$	CLR	v
G	86	UVES	4n	nov	n	$\leq 0.8''$	CLR	v
H	86	UVES	4n	mar	n	$\leq 0.8''$	CLR	v

4. Principal Investigator: MOLARO

Col(s): D. Reimers (1311), M. Wendt (1311), S. Lopez (1823), S. D'Odorico (1258), S. Levshakov (1403), C. Martins (1200), P. Bonifacio (1347), M. Centuri3n (1347), G. Vladilo (1347), S. Monai (1347)

Extract from the ESO Large Program proposal...



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185.A-0745(A) on 12 Jun 2010, VLT-Kueyen

Period	85	Mode	Visitor
Telescope	VLT-Kueyen		
Nights	5		
Programme Type	Large		
Instrument	UVES		
PI/Col	Molaro/ Petitjean/ Murphy/ Levshakov/ Reimers/ Srianand/ Lopez/ Martins/ Bonifacio/ Centuri'on/ Wendt/ D'Odorico/ Malec/ Vladilo/ Monai		
Observer			
Remarks	<i>Type: Large</i>		
Title	THE UVES LARGE PROGRAM FOR TESTING FUNDAMENTAL PHYSICS		
Abstract	Abstract not available		
Raw Products	FileList		
Publications	N/A		

Observations right now with our participation.

Summary

Measuring potential variation in μ or α requires excellent data and sophisticated data analysis.

The latter was developed during Phase I of the SFB (Wendt & Reimers 2008, Wendt et al. 2009)

ESO Large Program just launched, providing data of excellent quality (Wendt & Molaro 2010) for two years – starting now.

Germany's share in the LP stands or falls with the extension of the SFB.