Solar neutrinos experiment using torsion balance with sapphire crystal

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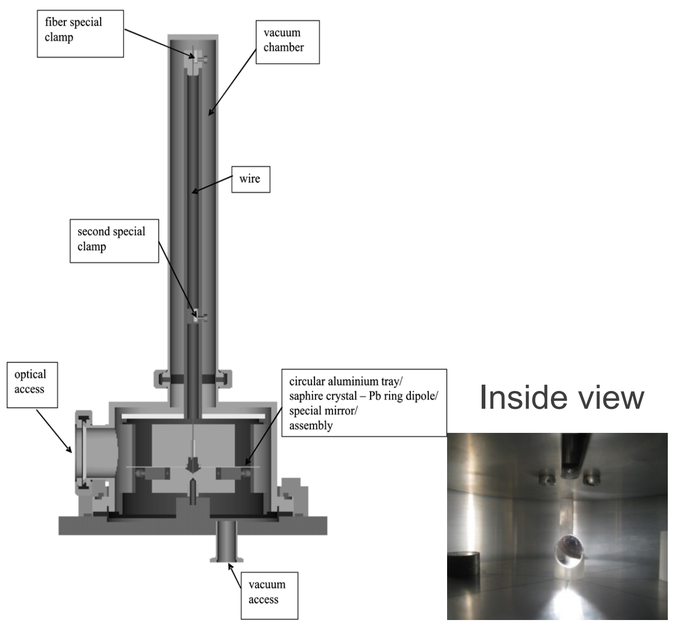
1. Eötvös experiment

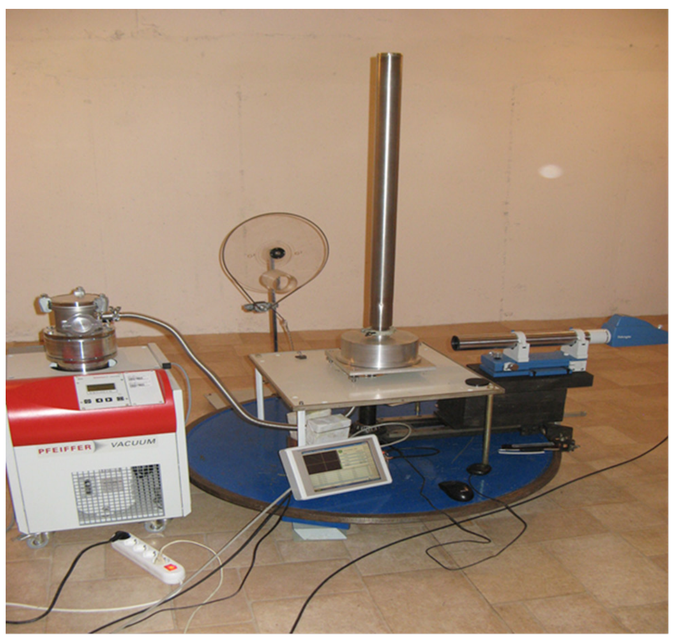
The torsion balance – schematic; inside view.



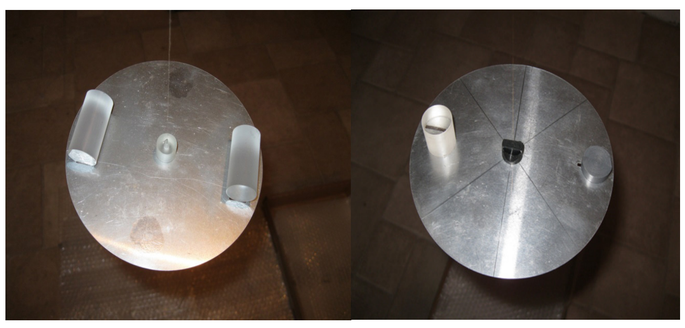
2. Nuclear reactors – source of antineutrinos

Nuclear reactors in the world

3. The torsion balance with autocollimator



4. Trays with sapphire and weights



Sapphire crystals

5. Results

- **M. Cruceru, G. Nicolescu, O. G. Duliu, I. Cruceru, IJMPA 26, 16(2011), 2773-2782;**
- **G. Nicolescu, *J. Phys. G: Nucl. Part. Phys.* 40 055201 (2013)**
- **diurnal effect for solar neutrinos observation;**
- **coherent scattering on high Debye temperature monocrystals;**
- **sapphire;**
- **"Cavendish-type" torsion balance is used;**
- **nearly perfect, infinitely stiff crystal may produce coherent scattering of neutrinos for macroscopic dimensions;**
- **The cross section for neutrino-scattering could enhanced by a large factor~N^2:**

$$\sigma = \frac{G_w^2 E_\nu^2}{4\pi\hbar^4 c^4}[N - Z(1 - 4\sin^2\theta_w)]^2$$

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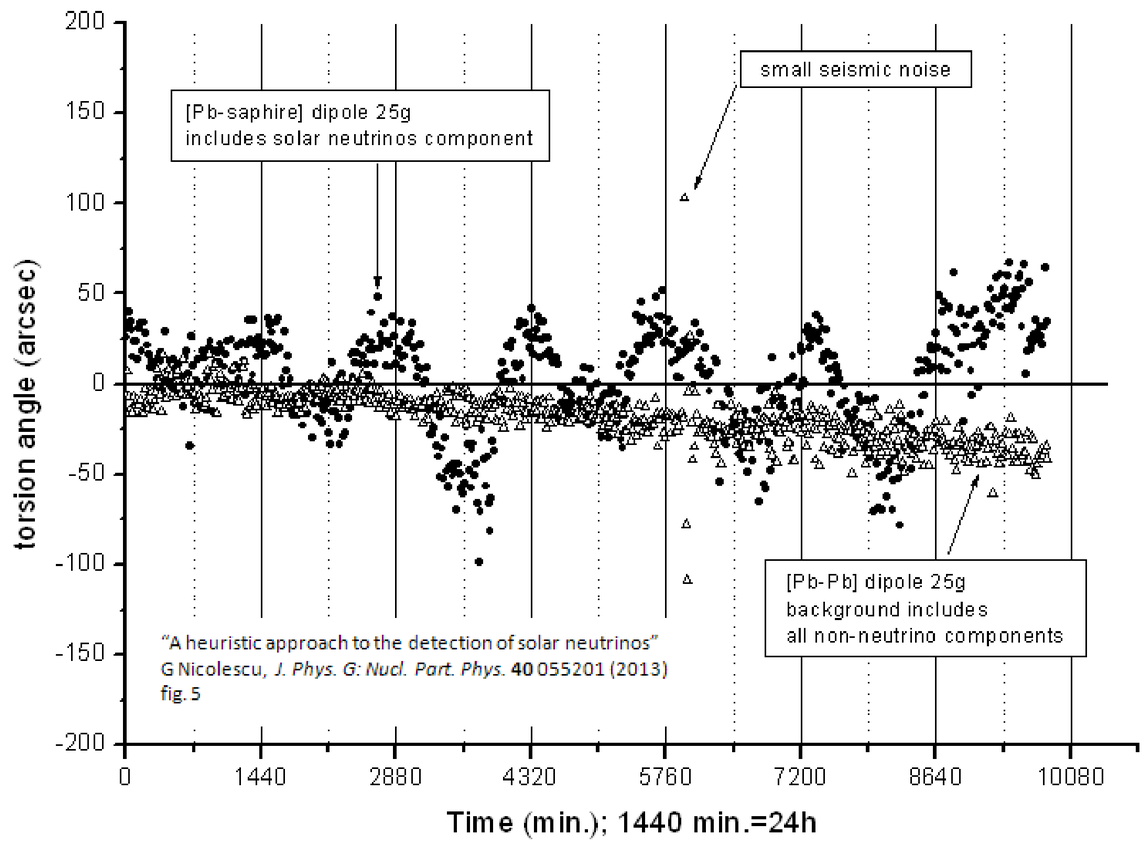
- **diurnal oscillations due to the change in sign of the torsion angle as determined by the rotation of the Earth around its own axis;**
- **Two dipoles: [sapphire crystal – Pb dummy] and [Pb dummy – Pb dummy];**

Experimental results are presented in the figure below:



6. Experimental Estimation of Solar Neutrinos Flux

- **3.8×10^{10}neutrinos/cm^2·s, solar neutrinos flux at the site of the experiment was obtained.**

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