**ABSTRACT**

The third phase of the Borexino experiment that’s referred to as SOX is devoted to test the hypothesis of the existence of one (or more) sterile neutrinos at a short baseline (5-50 m). The experimental measurement will be made with an artificial sources namely with a 144Ce-144Pr antineutrino source at the first stage (CeSOX) and possibly with a 51Cr neutrino source at the second one. The fixed 144Ce-144Pr sample will be placed beneath the detector in a special pit and the initial activity will be about 100-150 KCl. The start of data taking is scheduled for April 2018. The presentation gives a detailed description of the preparation for the first stage and shows the expected sensitivity.

**EXPERIMENTAL HINTS**

1) Accelerator anomaly: LSND [4-6]: Appearance excess of 51V in a 51V beam at $3.8\sigma$ KARMEN [5]: no signal

MiniBooNE [6,7]: Appearance excess of 51V in a 51V beam at $3.4\sigma$

2) Gallium anomaly [8-13]: SAGE, GALLEX: calibrations with 13C and 19Ar neutrino sources

3) Reactor anomaly [14-15]: Re-evaluation of reactor antineutrino spectra results [16,17]:

The reactor anomaly is strongly weakened by the recent results of Daya Bay [18]

**SETUP OVERVIEW**

Inner detector:
- Schillitator target 27.8 kg PPO (1.5 g/L)
- 2 buffer layers - 1000 ms PC+DMP (2.0 g/L, light quenching)

Characteristics of the Borexino detector
- Light yield: $-500\text{ p.e./MeV}$
- Energy resolution: $\sigma_E = 5\%$ at 1 MeV
- Spatial resolution: $\sigma_r = 10\text{ cm}$ at 1 MeV
- Pulse shape discrimination
- Ultra-high purity of the target

Fiducial mass: $-240\text{ t}$ (increasing possible)

4) Ce- Pr $\nu$ source

1JD - mostly background free: $-15\text{ eV/yr}$

Outer detector:
- Water tank - Cherenkov detector

200 m, 28° 8" PMTs in water

$^{144}\text{Ce}-^{144}\text{Pr}$ source in shielding $\sqrt{L/E} < 1\text{ m/MeV}$

**SENSITIVITY: RATE + SHAPE COMBINED ANALYSIS**

The "shape-analysis" is most powerful for $0.5\text{ eV}^2 < \Delta m^2 < 5.0\text{ eV}^2$

**SOURCE OVERVIEW**

Route:
- Mayak $>$ by train $>$ St. Petersburg $>$ by boat $>$ Le Havre $>$ by truck $>$ Saclay $>$ by truck $>$ LNGS

Time: $-3$ weeks

Loss of activity: $-5\%$

SOX will start data taking in April 2018

Two measurements with different calorimeters

Calorimetric measurement will reach $5\%$ precision or even better

**SOURCE RELATED SYSTEMATICS**

$^{144}\text{Pr}$-spectrum: old shape factor measurements differ by $10\%$

$N(W) = K_p (W/W_0)^{F(Z,Z,W)}$ for $F(Z,Z,W) = 1 + aW + bW^2 + cW^3$

exp setups involved: CEA, TUM, PNPI and Kurchatov Institute (Moscow)

$^{144}\text{Ce}$: new calibration campaign

1) E and I resolutions, 2) true inner vessel shape, 3) MC tuning, 4) efficiency Sources: $^{13}\text{AmBe},^{15}\text{Ni},^{28}\text{Ga}\text{Ge}(c),^{144}\text{Ce},^{54}\text{Mn},^{32}\text{Zn},^{96}\text{Kr}$

**RELATED REFERENCES**


**ACKNOWLEDGEMENTS**

The research was supported by the grant of the Russian Science Foundation (project № 17-72-20002).