Geo-neutrino, Earth heat flux, Earth electricity

L.B. Bezrukov (INR, Moscow)

the work done with cooperation A.Kurlovich, B.Lubsandorzhiev, A.Mezokh, V.Sinev, V.Zavarzina (INR, Moscow) and V.Morgaluk (A.N.Nesmeyanov Institute of Organoelement Compounds of Russian Academy of Sciences, Moscow)

Q-2018, Valday, May 27 – June 2

Hydride Earth (HE) model (primordially Hydrogen-Rich Planet)

was born 50 years ago and does not killed up to now

- Basic idea:

Planet chemical composition depends on distance from the Sun.

Earth chemical composition ≠ Asteroid Belt chemical composition. Larin's law:

$(X_M/X_{Si})_{Earth} = (X_M/X_{Si})_{Sun} \cdot F(E_{IP}(M))$; where X_M is the mass fraction in the planet mass of the chemical element with atomic number M, $E_{IP}(M)$ is the ionization potential of the chemical element with atomic number M

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Hydride Earth (HE)

- **There are U, Th, K in Lower mantle and Core**
- **Mantle → metallic**
- **External Core → FeH_4 + NiH_4 + MgH_4 + NaH_4 …**
- **Percentage of K in Earth mass is 2 %– 4 %**
- **HE model can explain experimentally observed value of Earth heat flux 300 TW. ^{40}K decay give the main contribution in Earth heat flux.** Leonid Bezrukov. Geoneutrino and Hydridic Earth model. Preprint INR 1378/2014. arXiv:1308.4163
- **HE model predicts that Earth heat flux is not stationary.**

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QUARKS-2016

On Geoneutrinos

L. B. Bezrukov, A. S. Kurlovich, B. K. Lubsandorzhiev, V. V. Sinev, V. P. Zavarzina and V. P. Morgalyuk

EPJ Web of Conferences **125**, 02004 (2016) DOI: 10.1051/epjconf/201612502004

- **Abstract.**

Experimental data on geoneutrinos allow to admit that masses of U, Th and K in the Earth can be up to *m*U = 1.7 · 1017 kg, *m*Th = 6.7 · 1017 kg and *m*K/*m*Earth ∼ 2%. These values correspond to intrinsic Earth heat flux in ∼300 TW. The most part of this flux goes up in rift zones as a heated gases. Argo Project results and the measurements of the Moon intrinsic heat flux support the existence of such a big flux. So large of U, Th,K abundances were predicted by Adjusted Hydridic Earth model.

*Conclus*ion. Geo**ν**. Exp.

- The fluxes of U and Th Geo**ν** are recorded.

U and Th BSE concentrations can be changed slightly by putting some U and Th in the Earth mantel and the core → the upper limit

$$H_U + H_{Th} \approx 40 \text{ TW}$$

- There is K Geo**ν** signal

$$2\% \rightarrow H_K = 260 \text{ TW}$$

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Geo-Neutrinos and the Earth's Internal Heat Flux

Physics of Particles and Nuclei, 2018, Vol. 49, No. 4, pp. 674–677. © Pleiades Publishing, Ltd., 2018.

Original Russian Text © L.B. Bezrukov, A.S. Kurlovich, B.K. Lubsandorzhiev, A.K. Mezhokh, V.P. Morgalyuk, V.V. Sinev, V.P. Zavarzina, 2018, published in Fizika Elementarnykh Chastits i Atomnogo Yadra, 2018, Vol. 49, No. 4.

Looking for antineutrino flux from ^{40}K with large liquid scintillator detector Looking for antineutrino flux from ^{40}K with large liquid scintillator detector

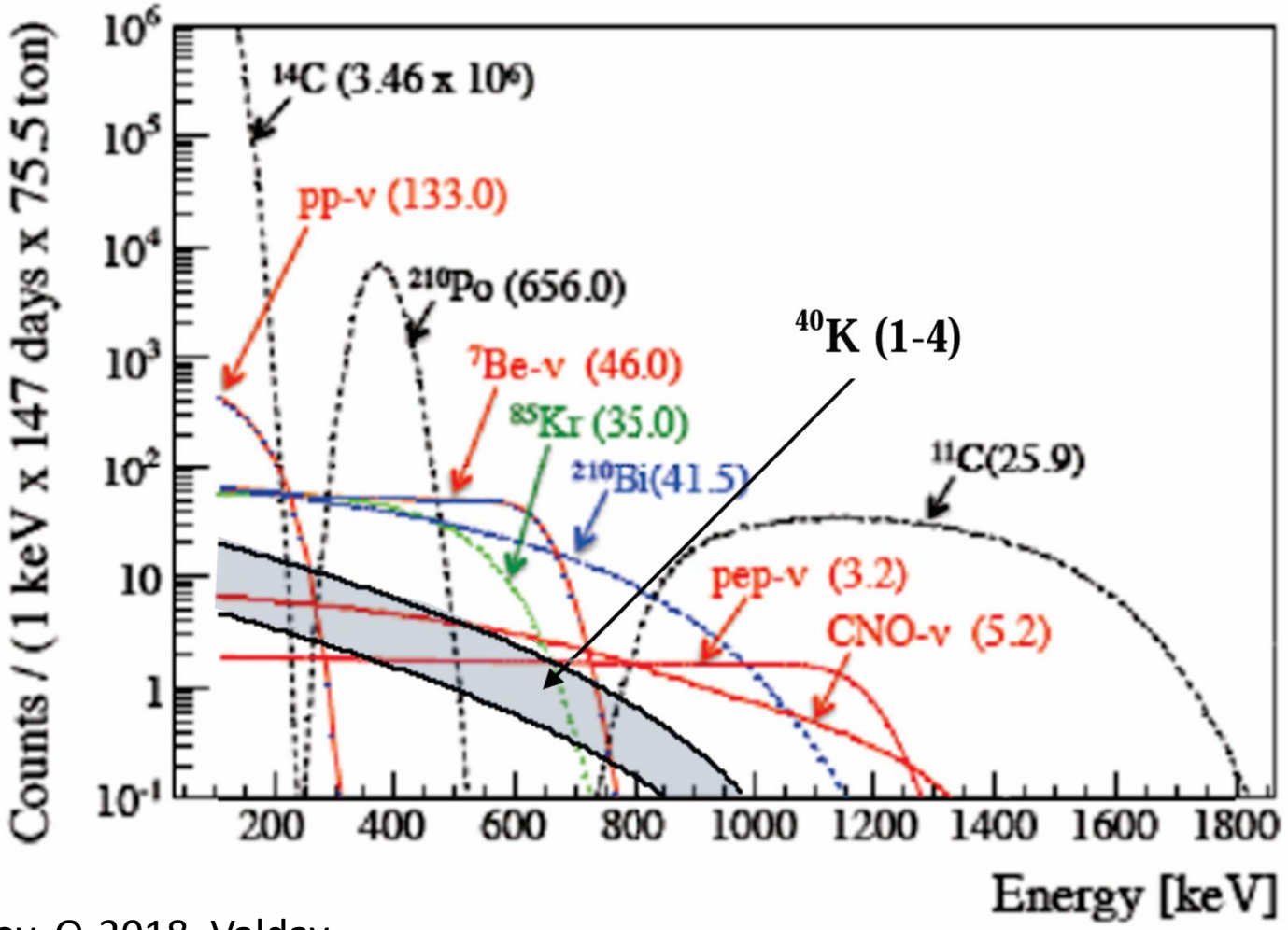
V.V. Sinev, L.B. Bezrukov (Moscow, INR), E.A. Litvinovich, I.N. Machulin, M.D. Skorokhvatov (Kurchatov Inst., Moscow & Moscow Phys. Eng. Inst.), S.V. Sukhotin (Kurchatov Inst., Moscow).

May 13, 2014. 4 pp.
Published in **Phys.Part.Nucl. 46 (2015) 2, 186-189**

Conference: C14-01-26 Proceedings, Valday
e-Print: **arXiv:1405.3140 [physics.ins-det]**

Recoil electrons energy spectrum from ^{40}K geoneutrinos in BOREXINO

$$\nu_e + e \rightarrow \nu_e + e$$



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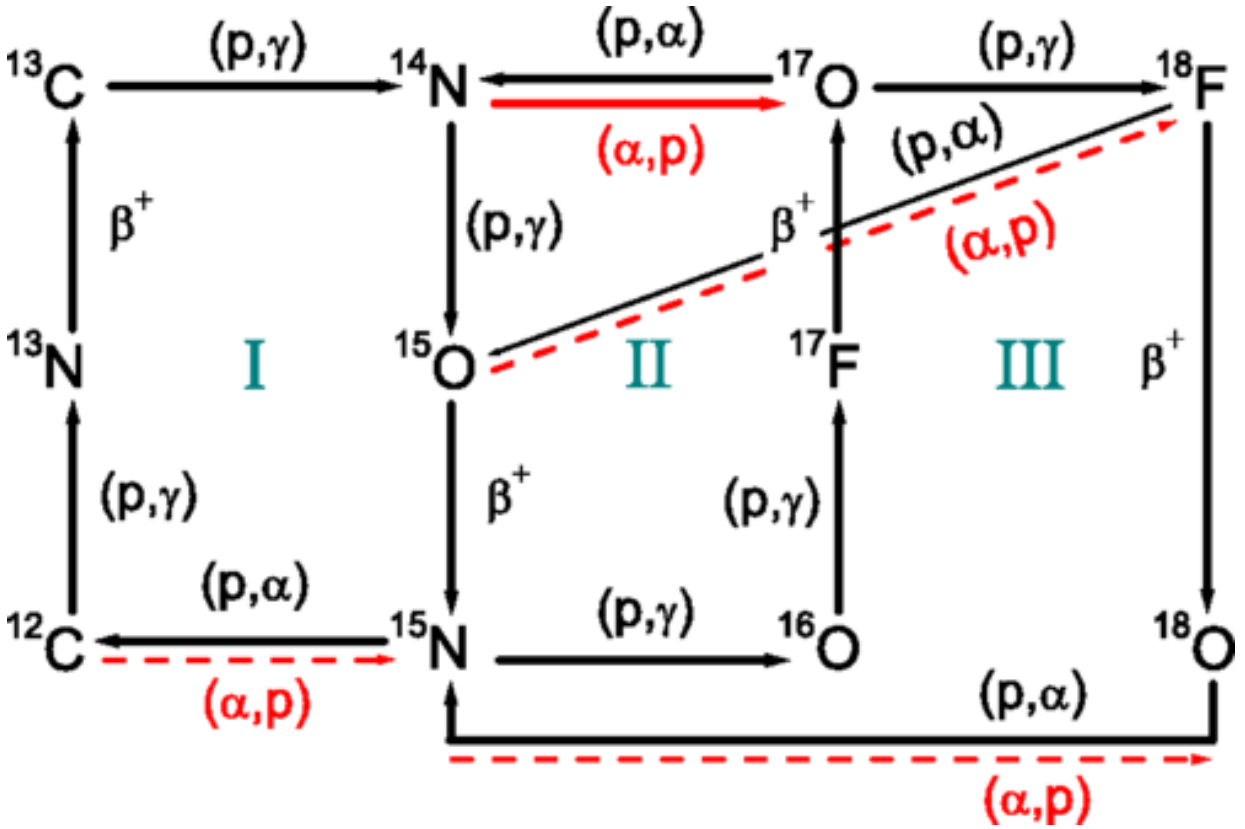
Comparative roles of pp chain reactions as a trigger for suprathermal processes in the solar core

Victor T. Voronchev, Yasuyuki Nakao, and Yukinobu Watanabe

Phys. Rev. C 96, 055803 – Published 13 November 2017



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Geoneutrinos

- ^{238}U, ^{235}U, ^{232}Th, ^{40}K decays in the Earth body are the source of geoneutrinos and heat.

- $^{238}U \rightarrow {}^{206}Pb + 8\alpha + 6e + 6\tilde{\nu}_e + 51{,}7$ MeV (47,7)
- $^{232}Th \rightarrow {}^{208}Pb + 6\alpha + 4e + 4\tilde{\nu}_e + 42{,}8$ MeV(40,4)
- $^{40}K \rightarrow {}^{40}Ca + e + \tilde{\nu}_e + 1.32$ MeV(0,598)prob.0,89

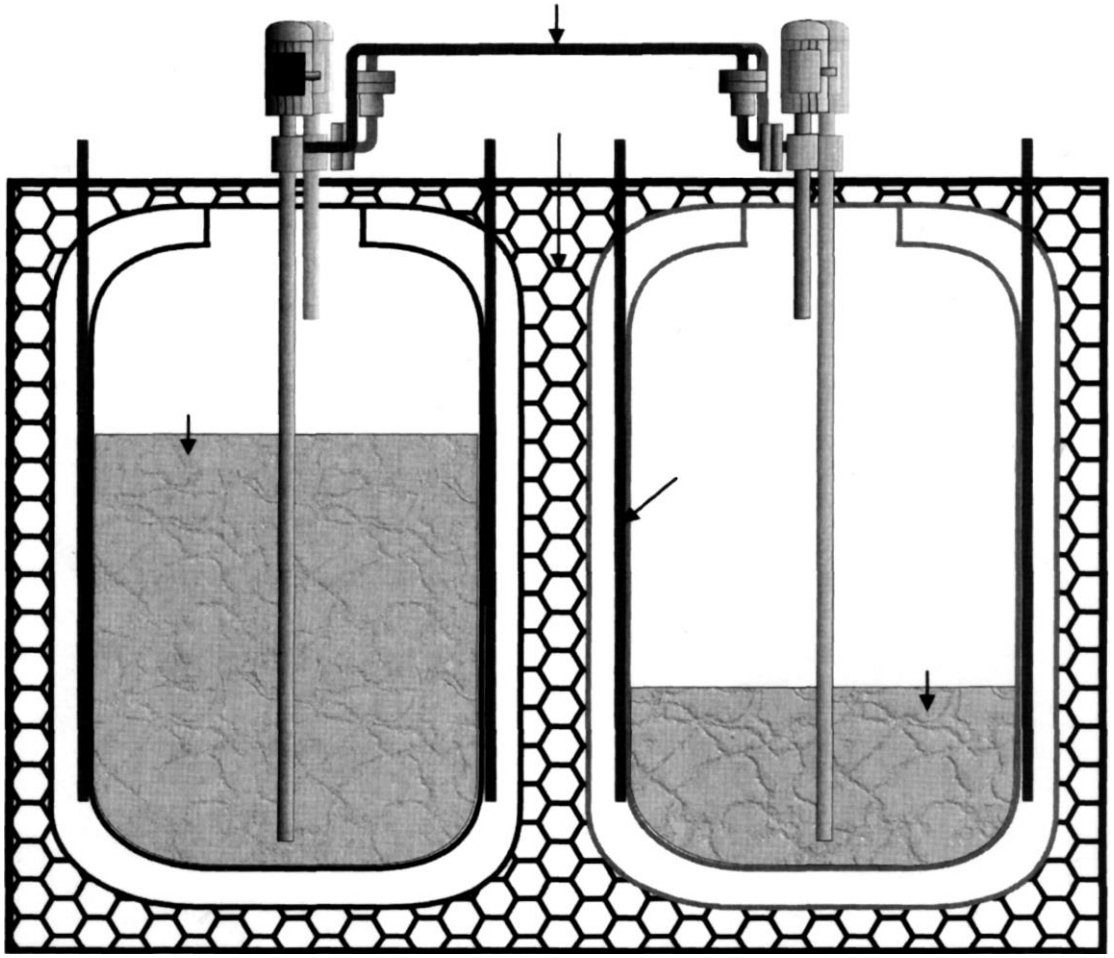
  $\rightarrow {}^{40}Ar + \Upsilon + \nu_e + 1.5$ Mev (1.46) prob.0,1066

Li – Be detector

Журнал технической физики, 2009, том 79, вып. 7, 133-136.

Исследование метода регистрации солнечных нейтрино с помощью литиевого детектора

© А.В. Копылов, И.В. Орехов, В.В. Петухов, А.Е. Соломатин



Experiment LENS

- Proposed by R. Raghavan
- The target - 115 In
- Sensitive to all type solar neutrino
- Not sensitive to 40K geo antineutrino

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Summary

- 40K geo-antineutrino contribute to Borexino single event according to Hydride Earth model. 2 – 3 events per day.

- The flux of CNO neutrino must be suppressed in this case. The reactions with fast alpha particles can be the reason of such suppression.

- The detector for CNO neutrino must be built.

Hydride Earth (HE)

- **There are U, Th, K in Lower mantle and Core**
- **Mantle → metallic**
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- **Percentage of K in Earth mass is 2 %– 4 %**
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- **HE model predicts that Earth heat flux is not stationary.**

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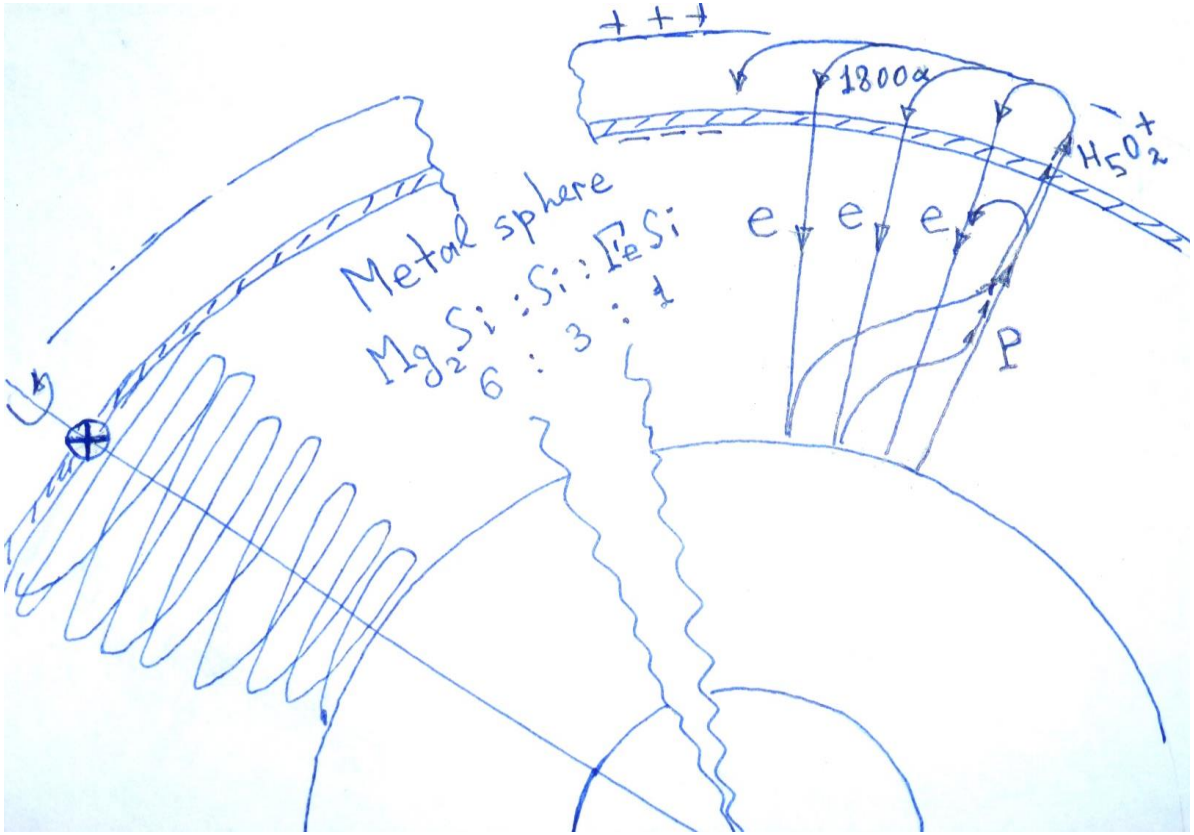
Verification of Hydride Earth (HE) model

- To prove the HE model we developed the Hydride Earth Electricity (HEE) model

- We prove the HEE experimentally. We observed the unusual predicted fact: The Earth crust (continents and ocean) saturates by positive ions (protons).

Earth electrical currents in the HE model



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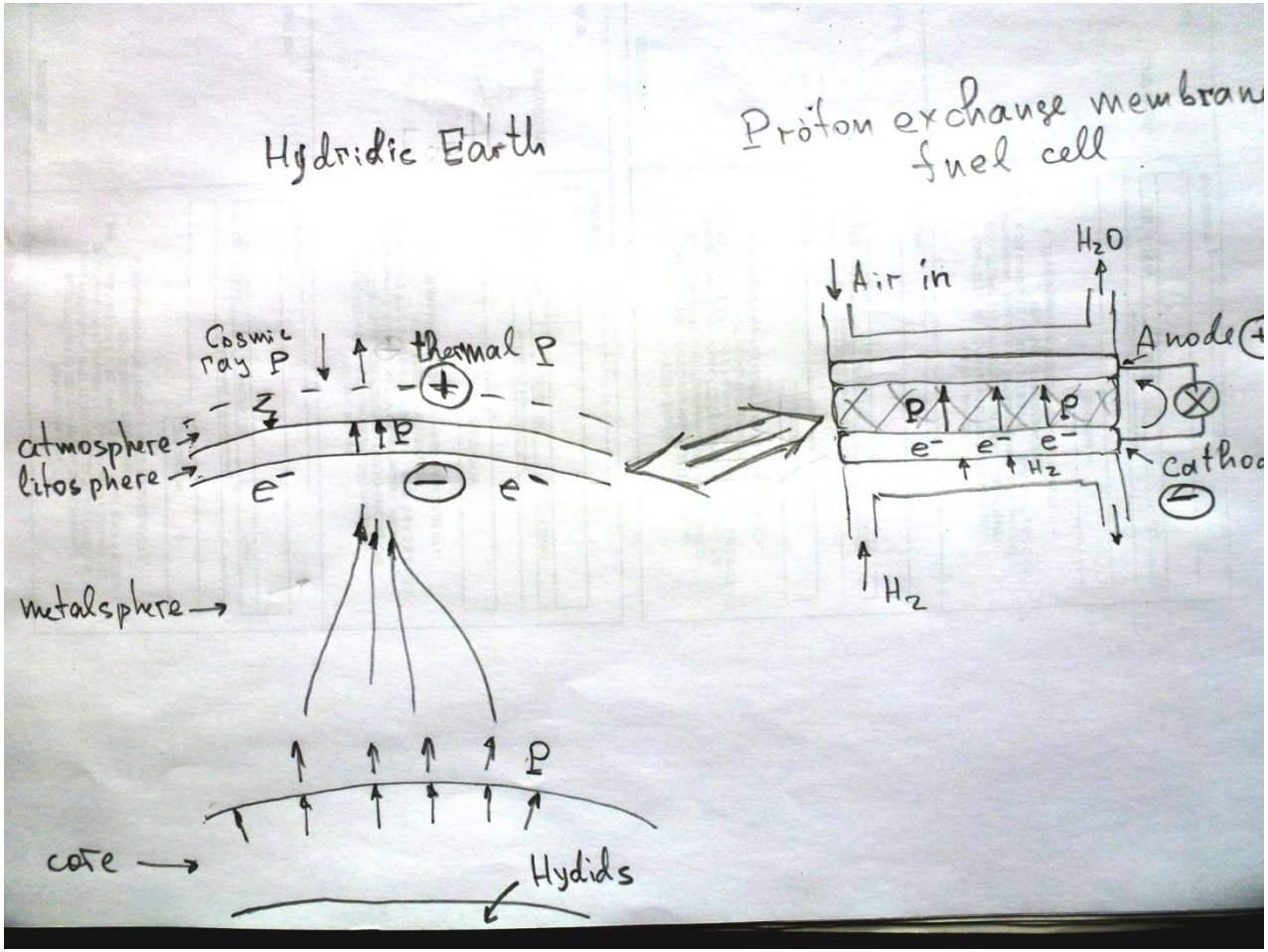
Negative charge is under litosphere

The International Astroparticle Physics Workshop

July 22 - 27, 2012

Ulan-Ude, Baikal, Russia



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On the Negatively Charged Layer of the Earth's Electric Field

Doklady Physics, 2018, Vol. 63, No. 5, pp. 177–179. © Pleiades Publishing, Ltd., 2018.

Original Russian Text © L.B. Bezrukov, A.C. Kurlovich, B.K. Lubsandorzhiev, A.K. Mezokh, V.P. Morgaluk, V.V. Sinev, V.P. Zavarzina, 2018, published in Doklady Akademii Nauk, 2018, Vol. 480, No. 2, pp. 155–157.

Hydride theory of Earth electricity

- The negative charge of “Earth capacitor” locates under Earth crust.
- The Earth crust (continents and ocean) saturates by positive ions (protons).
- The gases goes up from the Earth crust to atmosphere mostly by narrow jets. This gases are positive charged and can charge the “Earth capacitor”.

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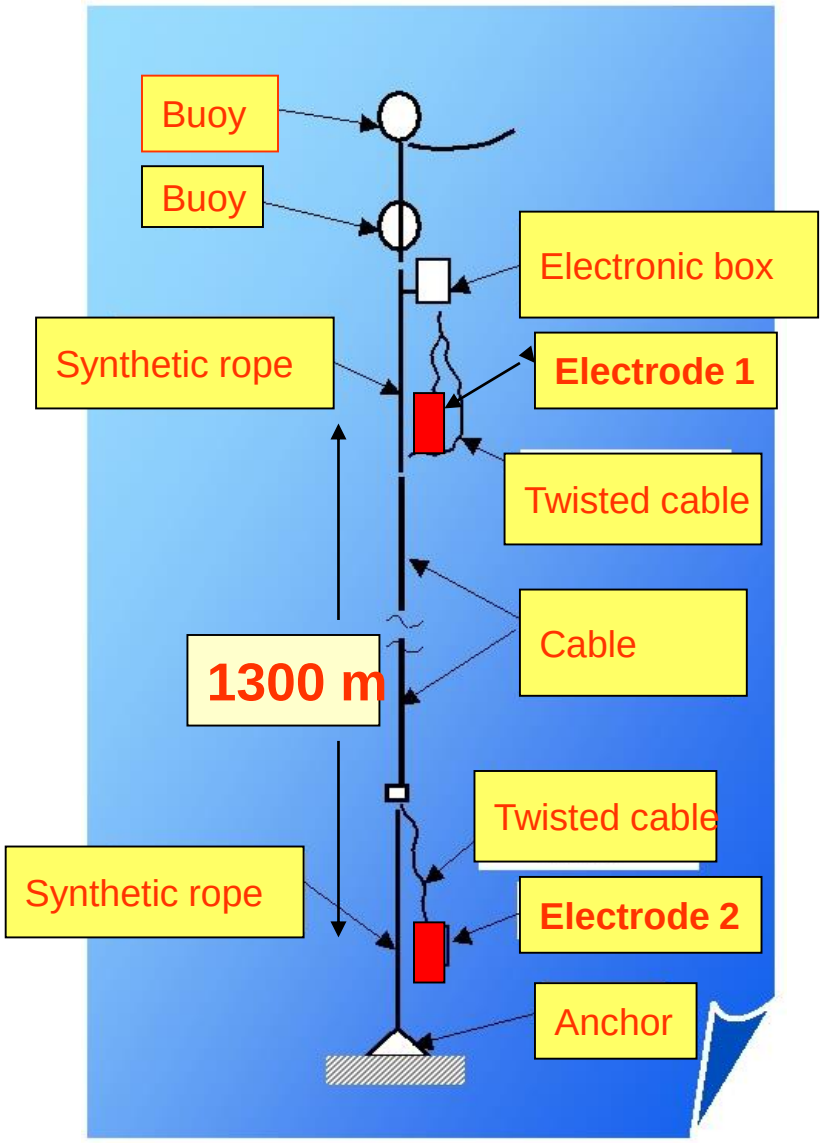
INR underground lab. Moscow

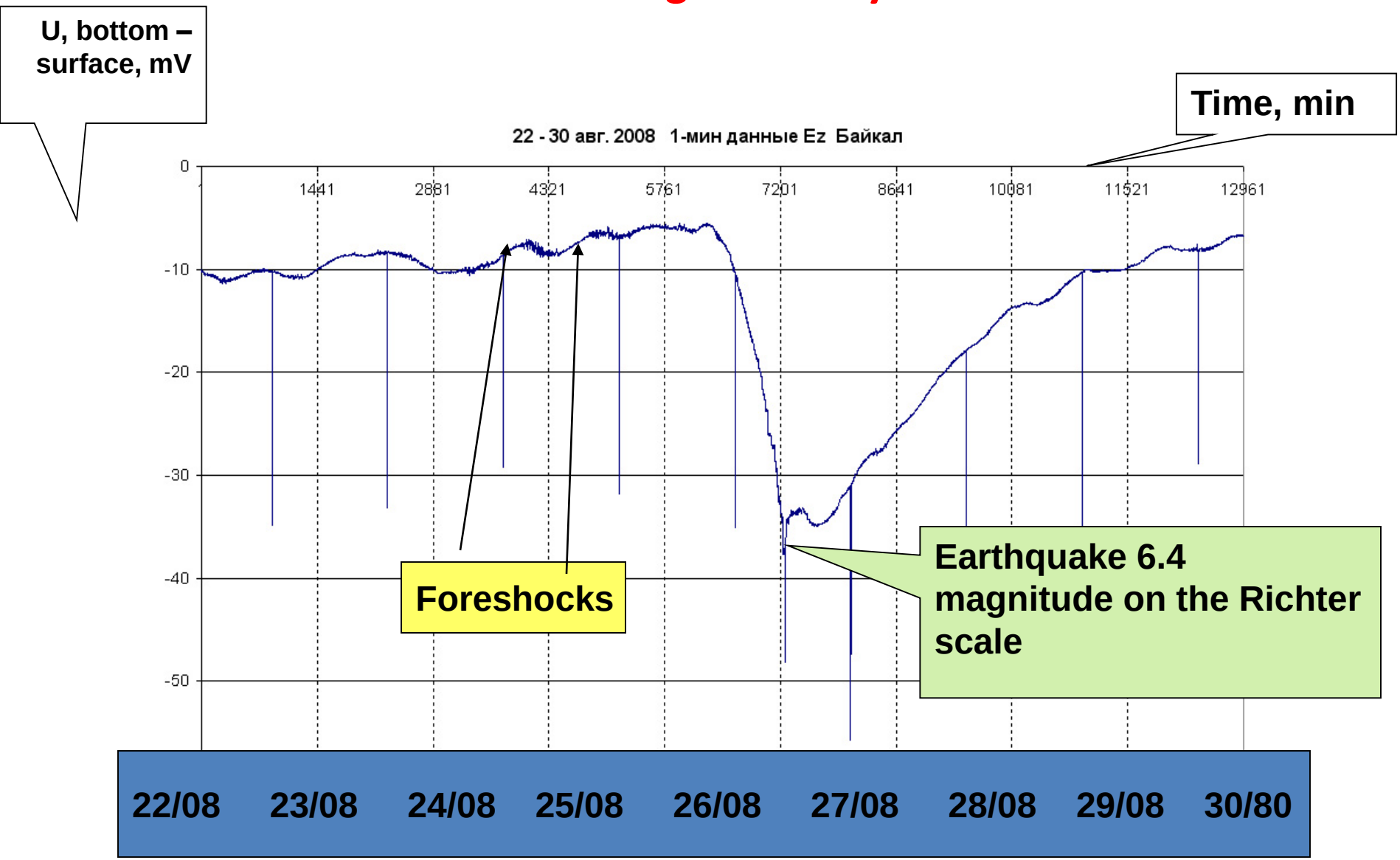
GEOPHYSICAL STRING

Electrode 2 connects to pluse (+) terninal of voltmeter



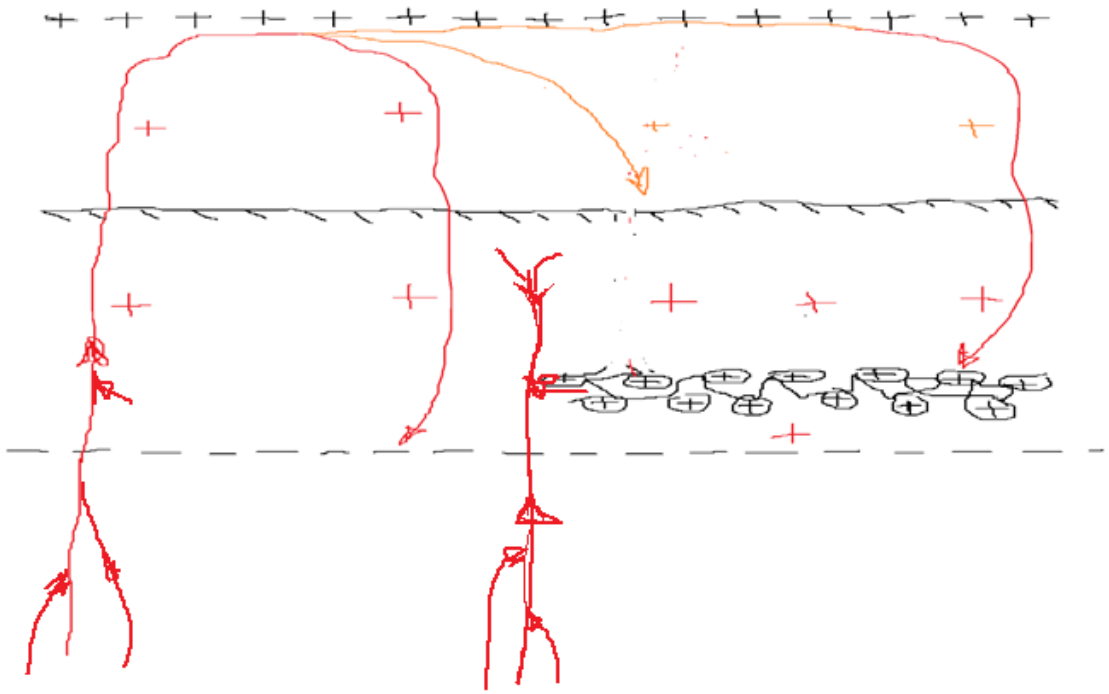
Surface – bottom electric potential difference

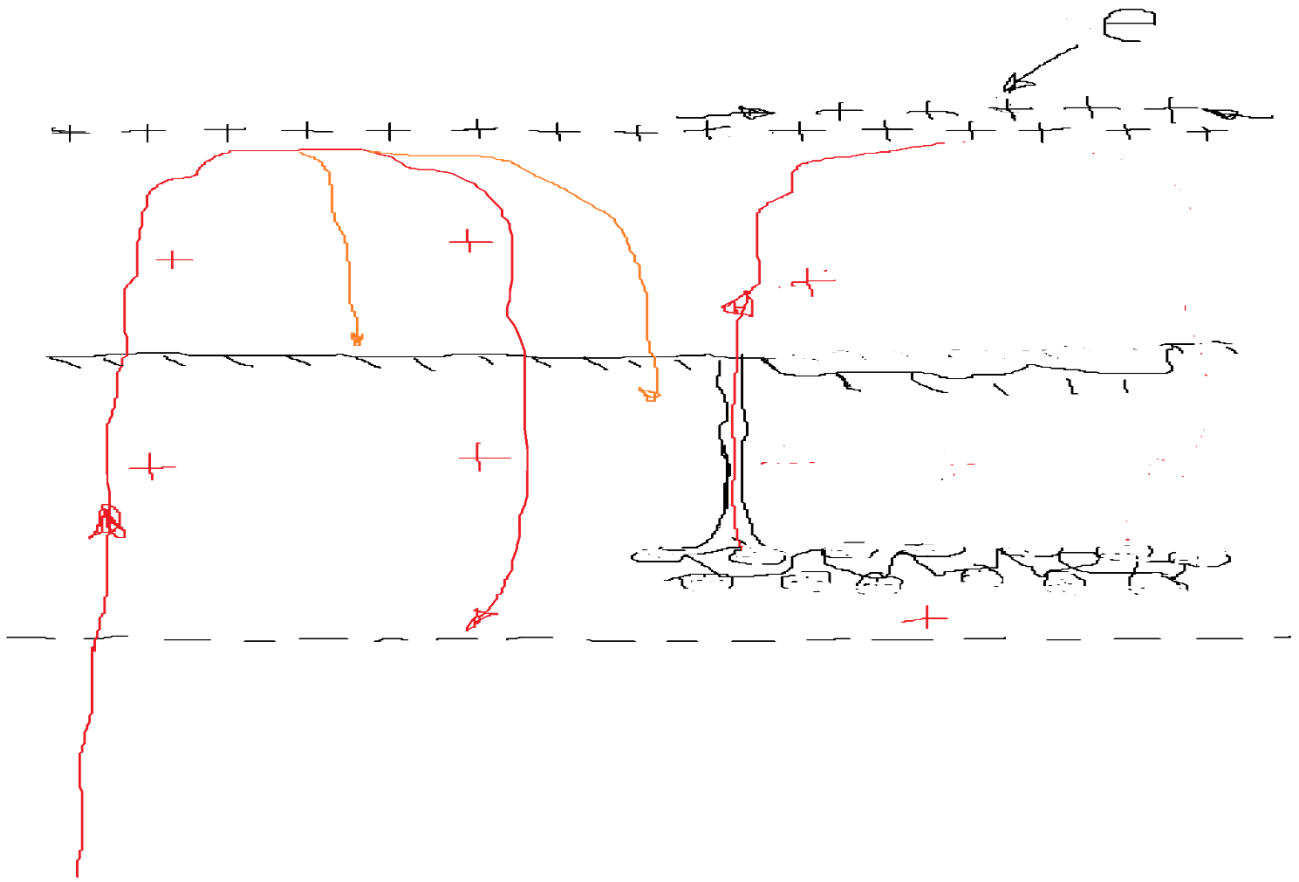
22 – 30 August 2008 year.



Earthquake

- The rocks at the multi-kilometer depth are penetrated by multiple pores and broken by cracks. This pores are full of gases. Then gases escapes the pores collapses.
- The gases are positive charged. So, the earthquake begins after gases escape from the pores and positive charge does not screen the negative located under crust.




e

Summary

- The Hydride Earth model predicts the huge amount of K in the Earth. 40K geo antineutrino must contribute to Borexino single events. The suppression of CNO flux follows from Borexino results in this case. The reactions with fast alpha particles in the Sun can be the reason of such suppression.

- We developed the Hydride Earth Electricity (HEE) model. We prove the HEE experimentally. We observed the unusual predicted fact: The Earth crust (continents and ocean) saturates by positive ions (protons).

Predicted overall initial composition of the Earth. Major elements are typed in bold (mass fraction larger than 0.1%).

Chemical differentiation of planets: a core issue. Herve Toulhoat, Valerie Beaumont, Viacheslav Zgonnik, Nikolay Larin, Vladimir N. Larin. Aug 2012. 15 pp. e-Print: arXiv:1208.2909 [astro-ph.EP]

Element	wt %	mol %	Element	wt %	mol %	Element	wt %	mol %
H	**1.830E+01**	**87.43**	**Mg**	**1.389E+01**	**2.75**	Sc	3.601E-03	<0.01
He	1.856E-05	<0.01	**Al**	**8.769E+00**	**1.57**	**Ti**	**2.100E-01**	**0.02**
B	4.220E-05	<0.01	**Si**	**9.028E+00**	**1.55**	V	2.329E-02	<0.01
C	**7.550E-01**	**0.30**	P	5.715E-03	<0.01	**Cr**	**1.046E+00**	**0.10**
N	5.562E-03	<0.01	**S**	**3.793E-01**	**0.06**	**Mn**	**4.518E-01**	**0**.04
O	**1.391E-01**	**0.04**	Cl	4.210E-04	<0.01	**Fe**	**1.942E+01**	**1.67**
F	1.260E-07	<0.01	Ar	1.883E-04	<0.01	Co	6.153E-02	0.01
Ne	2.675E-06	<0.01	**K**	**3.760E+00**	**0.46**	**Ni**	**1.627E+00**	**0.13**
Na	**1.341E+01**	**2.81**	**Ca**	**8.792E+00**	**1.06**			
					Balance		1,00E+02	100

Examples of this areas were studied in Russia and Carolina in the US

herein called the "Carolina Bays" (Fig. 1). The measured hydrogen

fluxes are

between

200 and

4400

m3/day/km2

[Beaumont et al., 2015].

Geology of hydrogen reservoirs

Hydrogen, having high calorific potential and being convertible to electricity and heat, is considered as an efficient energy carrier capable of transporting and storing energy [Panfilov, 2010]. The main application of hydrogen is the mobility sector, and it can also be injected into the natural gas grid. Large-scale hydrogen accumulations exist underground in the form of natural underground hydrogen reservoirs (UHR) in thermal aquifers.

UHR's have been discovered recently in all the parts of the world.