

Possibility of earthquake prediction with CREDO

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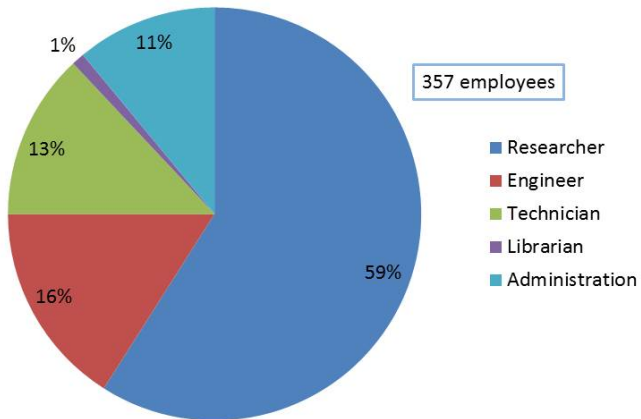
Overview



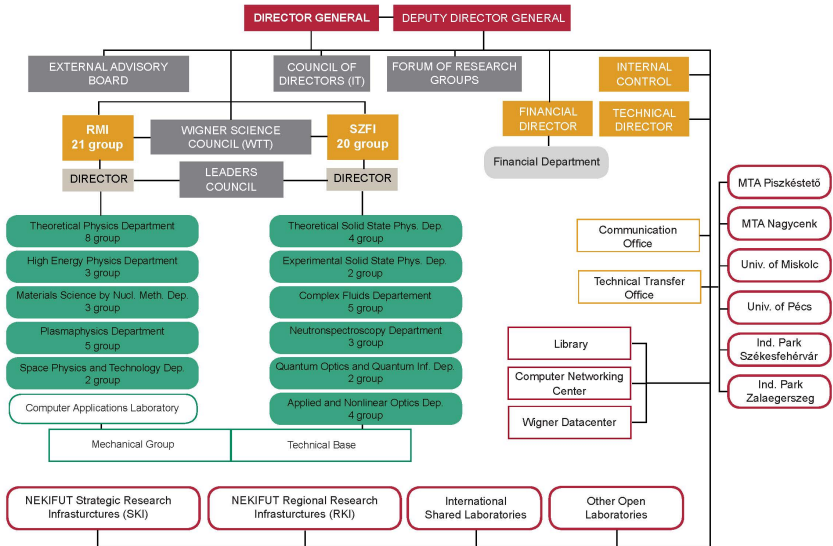
- 1 Short introduction: the Wigner RCP
- 2 My main research area
- 3 Possibilities of earthquake prediction
 - Literature
 - Possible explanation
 - Method
 - H2020 citizen science call

Structure and staff of Wigner RCP I.

Total staff



Structure and staff of Wigner RCP II.



Theoretical Physics Department

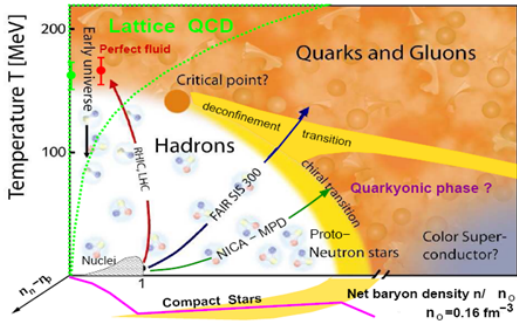


Research Groups:

- Particle Physics and Field Theory Research Group
- Heavy-ion Physics Research Group
- MTA Momentum Holographic Quantum Field Theory Research Group
- Gravitational Physics Research Group

Envisaged phase diagram of strongly interacting matter

Phase diagram in the $T - \mu_B - \mu_I$ space



- At $\mu_B = 0$ $T_c = 153(3)$ MeV
- Is there a CEP?
- The T -dependence of thermodynamical quantities like pressure, interaction measure, quark density is known from lattice only at $\mu_B = 0$.
- At which μ_B is there the phase boundary for $T = 0$?
- In medium changes of masses and widths

Why is my background relevant here? → look at a new field from diff. perspectives

Earthquake prediction

Experimental indication (one case)

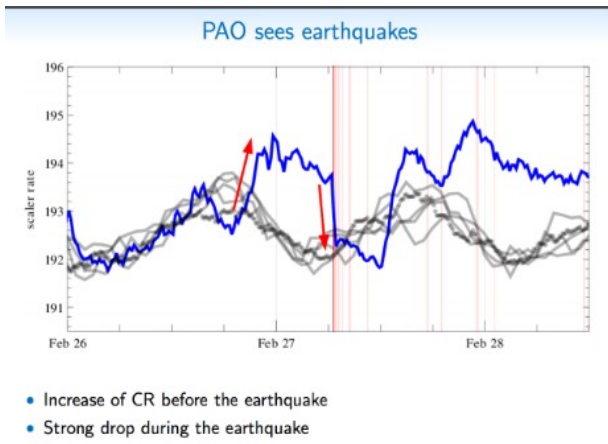


Figure: Increase in the low energy signal rate at least six hours before a $8.8M_L$ earthquake in 27.02.2010, 06:34:14 UTC at Chile [by A. Saleh]

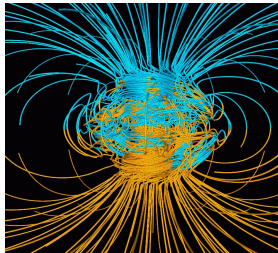
Relevant papers from the literature

- A. L. Morozova *et al.*, “Variations of the Cosmic Ray Fluxes as a Possible Earthquake Precursor” , Phys. Chem. Earth (A), Vol. **25**, No. 3, pp. 321-324, 2000: [Correlations between the annual number of earthquakes and air pressure, cosmic ray fluxes, interplanetary \$B\$ are investigated. Some correlation was found.](#)
- S. M. Korotaeva *et al.*, “The Effect and Forerunners of the Earthquake of August 28, 2008, in the Vertical Component of the Electric Field in Lake Baikal” , ISSN 1028334X, Doklady Earth Sciences, 2011, Vol. **438**, Part 2, pp. 842–845: [Changes of \$E_z\$ electric field component hours before an earthquake of 5.9 – 6.4 \$M_L\$](#)
- Romanova, N. V. *et al.*, “On the magnetic precursor of the Chilean earthquake of February 27, 2010” , Geomagnetism and Aeronomy, Volume **55**, Issue 2, pp.219-222, 2014: [Anomalous geomagnetic disturbance \(three days before the event\) was a mid-size substorm that was not related to seismic activity.](#)

Basically no physical explanation

Change of magnetic field due to EQ

geomagnetism:



(<https://commons.wikimedia.org/w/index.php?curid=1712490>)

Earthquake → stress wave in earth → perturbing the geodynamo and/or deformation of magnetostrictive materials → changes of magnetic field → **incoming particle flux changes**

- perturbation of geodynamo:
MHD equations + seismic waves
- the Villari or inverse magnetostrictive effect: change of magnetization of a magnetostrictive material due to mechanical stress.

What can be done?



- many data (seismic, magnetic field, CR flux) are needed to check the hypothesis
- one can start with huge EQ events of the past
- these should be analyzed to extract possible correlations e.g.
- on the other hand → model building
- effects of changes in Earth's magnetic field on the incoming flux can be investigated
- different scenarios can be tested and compared with data
- as usual move from simple to complex

To sum up

Highly interdisciplinary problem: in the intersection of geology (seismology, geophysics, tectonics), and physics (classical mechanics, classical electrodynamics, and astroparticle physics).

Important questions:

- Is it possible that some hidden effect that changes the geodynamo and/or the Villari effect is able to cause such a change in the incoming particle flux?
- How can the delay between the increased flux and the mechanical wave be explained?

For this project to be successful data (incoming flux, magnetic field) from all around the world is needed, which can be done only with a global approach such as CREDO.

H2020 SwafS citizen science call result 2018



CALL RESULTS



Published: 27.10.2017

Deadline: 10.04.2018

Available budget: EUR 63.5 million

Budget per topic/type of action with separate 'call-budget-split':

– SwafS-15-2018-2019: Exploring and supporting citizen science (CSA/RIA) : EUR 6 million

The results of the evaluation are as follows:

Topic code	Topic short name	Number of proposals submitted	Number of ineligible proposals	Number of inadmissible proposals	Number of above-threshold proposals	Total budget requested for above-threshold proposals (EUR)
SwafS-15-2018-2019	Exploring and supporting citizen science	33		2	16	33,215,117.76

We recently informed the applicants about the evaluation results for their proposals.

 For questions, please contact the [Research Enquiry Service](#).

Thank you for your attention!