



# Sterile Neutrinos

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Group 2:  
Andreas | Melanie | Hannah | Leon



# Missing Chirality

Three Generations  
of Matter (Fermions) spin  $\frac{1}{2}$

	I	II	III
mass →	2.4 MeV	1.27 GeV	171.2 GeV
charge →	$\frac{2}{3}$	$\frac{2}{3}$	$\frac{2}{3}$
name →	<b>u</b> up	<b>c</b> charm	<b>t</b> top
Quarks	<b>d</b> down	<b>s</b> strange	<b>b</b> bottom
	<b><math>\nu_e</math></b> electron neutrino	<b><math>\nu_\mu</math></b> muon neutrino	<b><math>\nu_\tau</math></b> tau neutrino
	<b>e</b> electron	<b><math>\mu</math></b> muon	<b><math>\tau</math></b> tau
Leptons	0.511 MeV	105.7 MeV	1.777 GeV

Bosons (Forces) spin 1	<b>g</b> gluon
	<b><math>\gamma</math></b> photon
	<b>Z<sup>0</sup></b> weak force
	<b>W<sup>±</sup></b> weak force

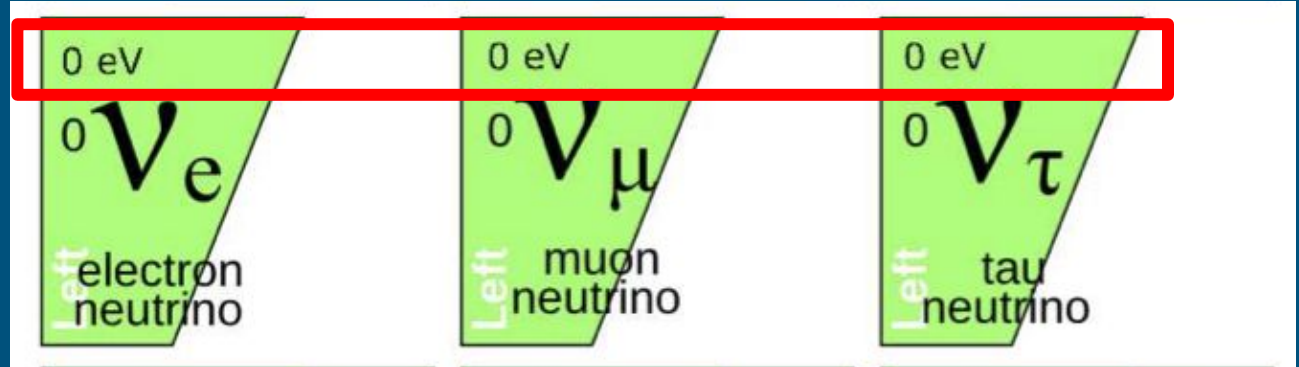
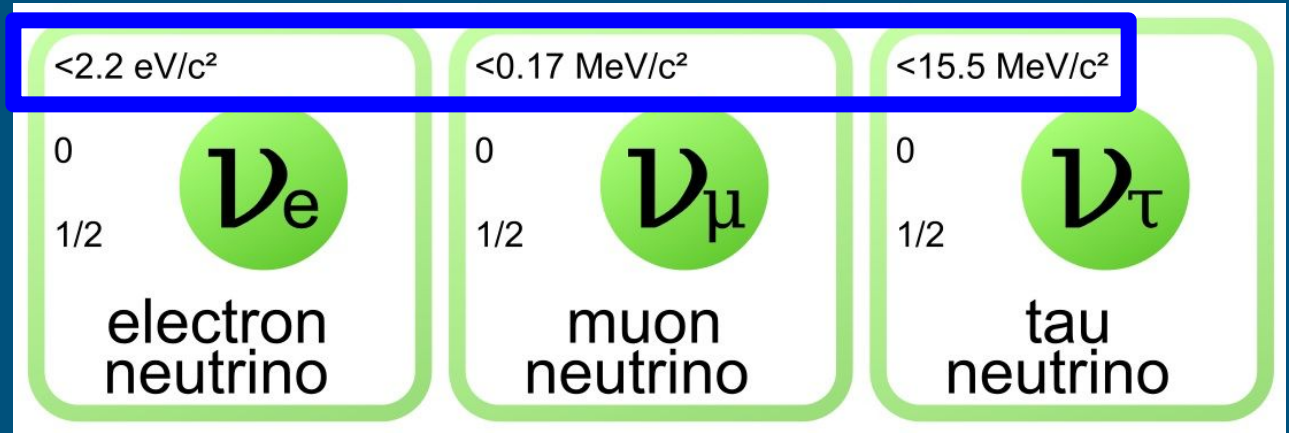
<b>H</b> Higgs boson
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spin 0

# Missing Mass

Neutrino Oscillation

SM



**Postulate:**  
**Right-handed sterile neutrino**

<b>Status</b>	Hypothetical
<b>Types</b>	unknown
<b>Mass</b>	unknown
<b>Electric charge</b>	0
<b>Color charge</b>	none
<b>Spin</b>	$\frac{1}{2}$
<b>Spin states</b>	2
<b>Weak isospin projection</b>	0
<b>Weak hypercharge</b>	0

# Properties

 No electromagnetic interaction

 No strong interaction

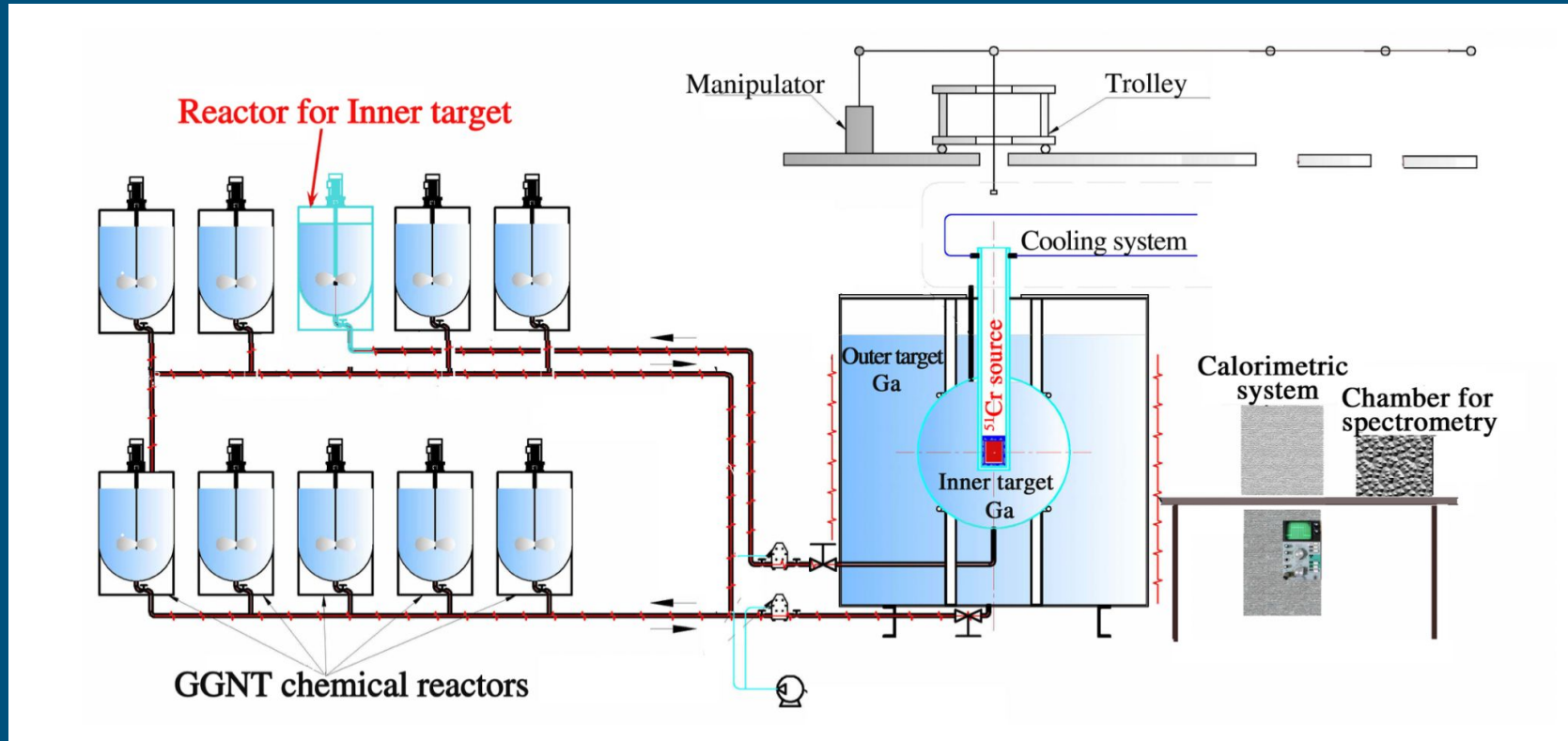
 No weak interaction

**Only Gravitational interaction**

... Dark Matter?!

What's already been done

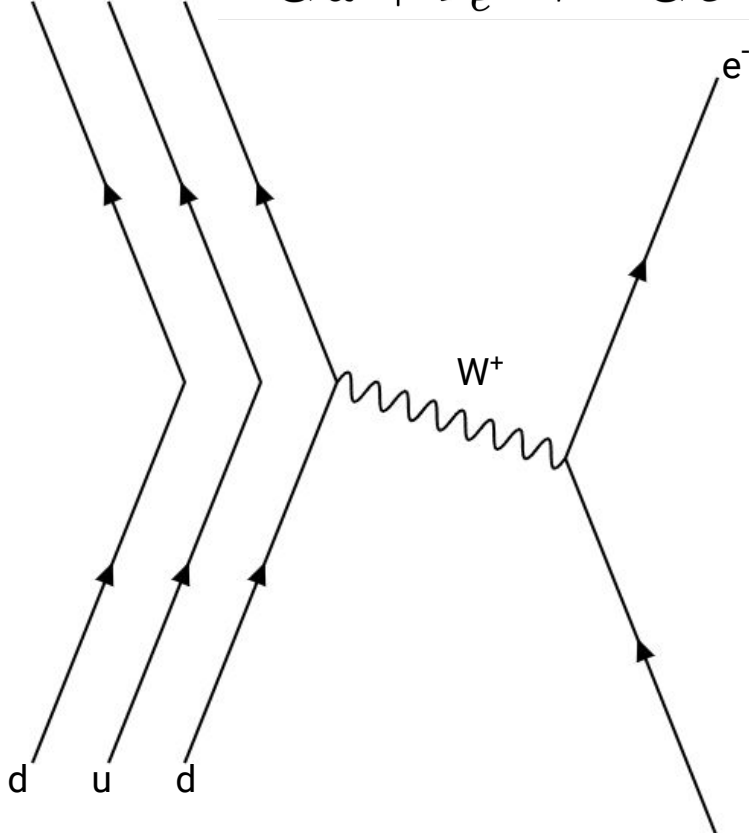
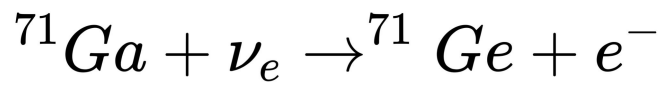
# BEST experiment (Baksan Experiment on Sterile Transitions)



Proton in Germanium



d u u



Neutron in Gallium



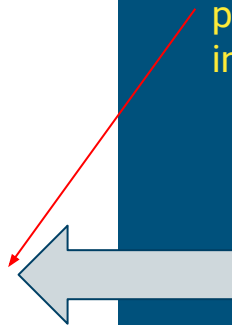
d u d

W<sup>+</sup>

e<sup>-</sup>

ν<sub>e</sub>

If a sterile neutrino is produced, no interaction will occur



Neutrino from decay of Chromium





# What is the BEST experiment?

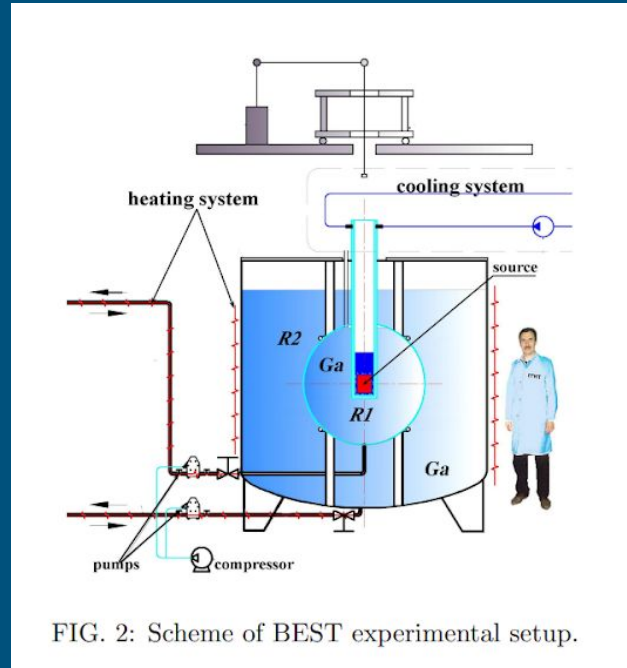
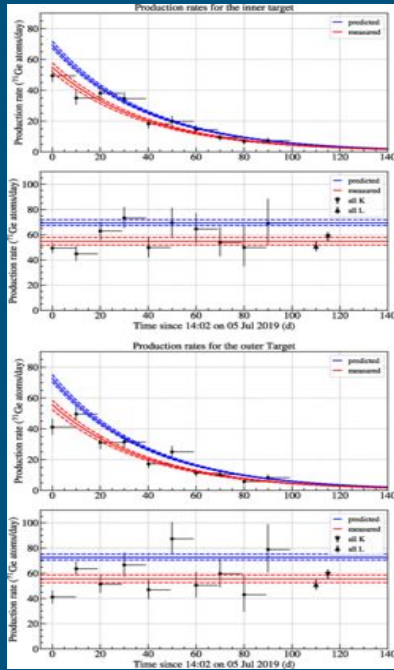


FIG. 2: Scheme of BEST experimental setup.



**So there's already the B.E.S.T. ....**

**Big Extra Terrestrial Test Experimente du Recherche**

**... But we will make it B.E.T.T.E.R. !!!!**



# It used to be...

Baksanskaya Neytrinnaya Observatoriya



Baksanskaya  
Neytrinnaya Observato...  
Observatory in Neytrino, Rus...

The Baksan Neutrino  
Observatory is a scientific  
laboratory of INR RAS located in  
the Baksan River gorge in the  
Caucasus mountains in Russia...  
[Wikipedia](#)

[People also explore...](#)



# Alteration 1: Set up the experiment on Pluto



## Why Pluto?

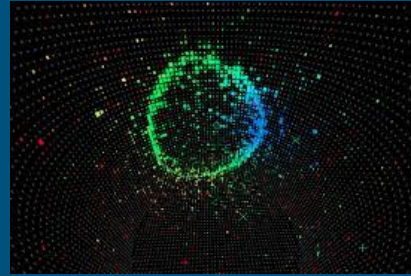
- Atmospheric pressure of 1 Pa
- Pluto gets 1/1600 as much light from the sun as Earth does
- Fewer atmospheric and solar neutrinos to interfere with experiment



# Alteration 2: Use more concentrated Chromium sample



Chromium Sample



Neutrino



Gallium



Germanium

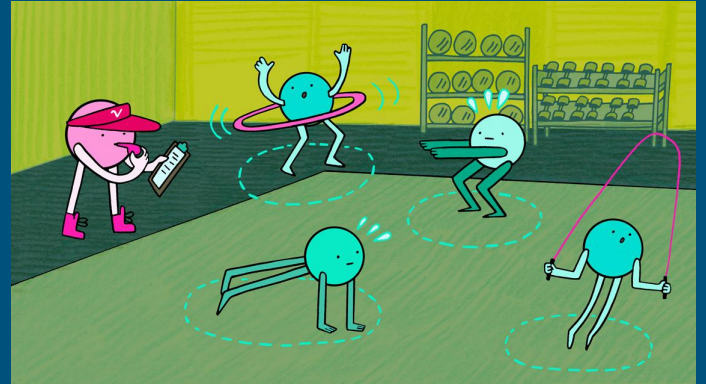
# Alteration 3: Create a satellite network

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Thank you for listening!





Any Questions?

