

Benefits I have gained from the STEAM-TEACH programme

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Meeting STEAM Education

► 2017.

- in Helsinki, Finland

► Qualitative didactical experiments

- „Art-pieces of gravity”

MIG 2018

- „Farewell to the Grand-K”

MIG 2019

- „Media 2” subject

MIG 2008-2022



Building a new team: a S-TEAM

- ▶ STEM is in crises worldwide
- ▶ Methodological research: from new content to new, motivating techniques of teaching and learning
- ▶ Dale's pyramid: active learning in the focus
- ▶ The best model of a healthy personality: arts and science in a good equilibrium
- ▶ Our S(cience) - TEAM: university fellows, teachers of different majors (mostly physics teachers)



Non-linear phenomena in STEAM approach: chaos theory

The historical background:

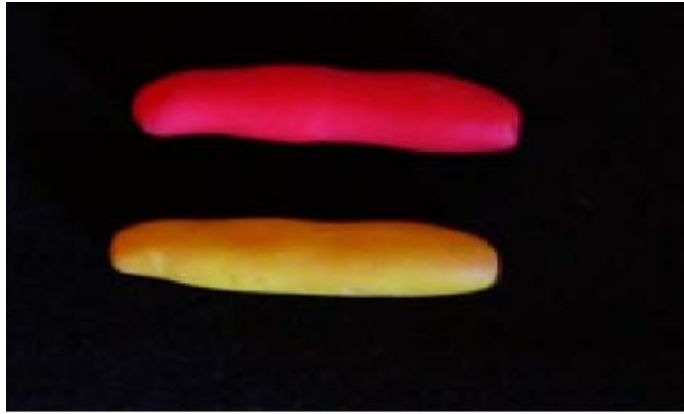
- Astronomy - Poincare
- Giroscope - Kovalevskja (**peonza games**),
- Radiolocator - Carlwright,
- Weather - Lorentz, etc.

And other phenomana:

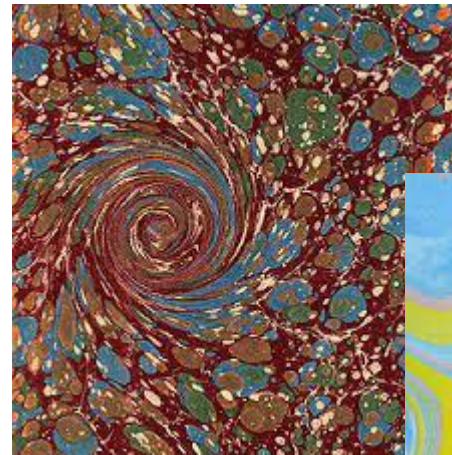
- **(magnetic) pendula**,
- **yoyo** and „shimi”-ball etc.



„mixing-up” chaotic phenomena



6.a.



Videos on the internet (only instabilities)

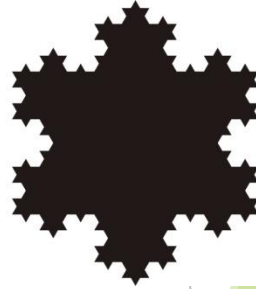
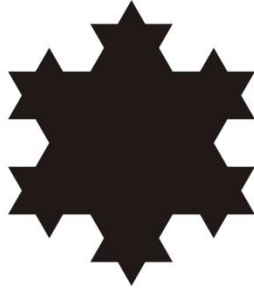
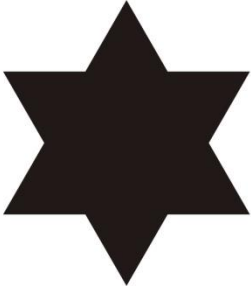
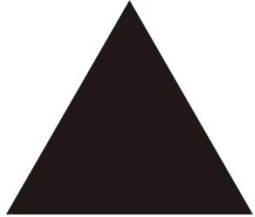
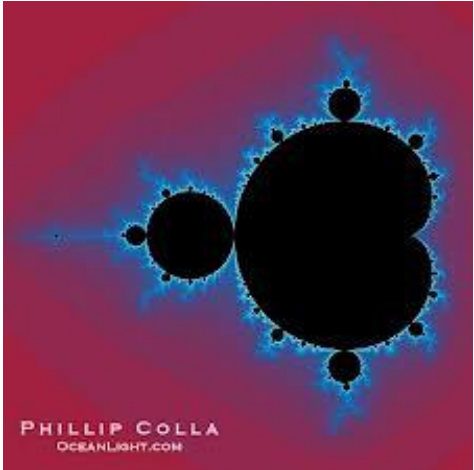


Chaos on the roads: traffic issues



WWW.STILEPROJECT.COM

The mathematics of chaos theory: fractals (1975-)



$$\begin{array}{c}
 \frac{1}{r} \\
 \hline
 \frac{r}{r^2} \quad \frac{r}{r^2} \\
 \dots \quad \dots \\
 \dots \quad \dots \\
 \dots \quad \dots
 \end{array}$$

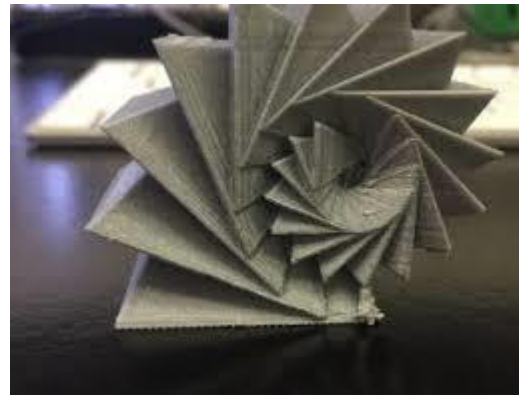


The Sierpinsky triangle in 3D (iteration)



IT and origami

- ▶ A multitude of fractal making programs are easily available free on the internet
- ▶ Fractal origamis

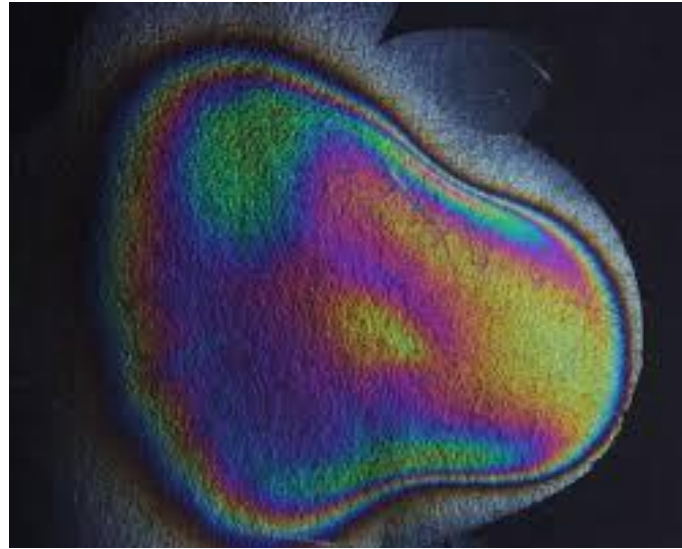


Sound waves: music and musical instruments

- Introduce your musical instrument (if you play one)
- Speech, intonation and singing (sound waves)
- Make a musical instrument



Water



Mass, weight, gravity

- ▶ Art-pieces of gravity project, 2018.
 - LIGO, gravitational waves, 2017
 - Eötvös centenary, 2019
- ▶ Farewell to the „Grand-K”, 2019.
 - Zoltán Bay, meter, 1968. (Hungarian)
 - last one to retire the „Grand K”, 2019.

[“Art-pieces of gravity” \(office.com\)](http://office.com)

“Art-pieces of gravity”



LIGO, the curvature of space-time



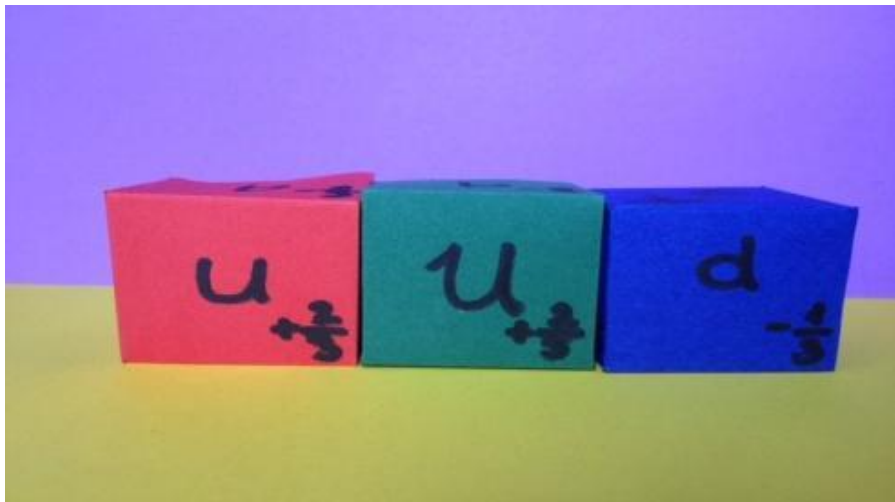
Particle physics: paper cubes

Atom - the meaning

The structure of the atom

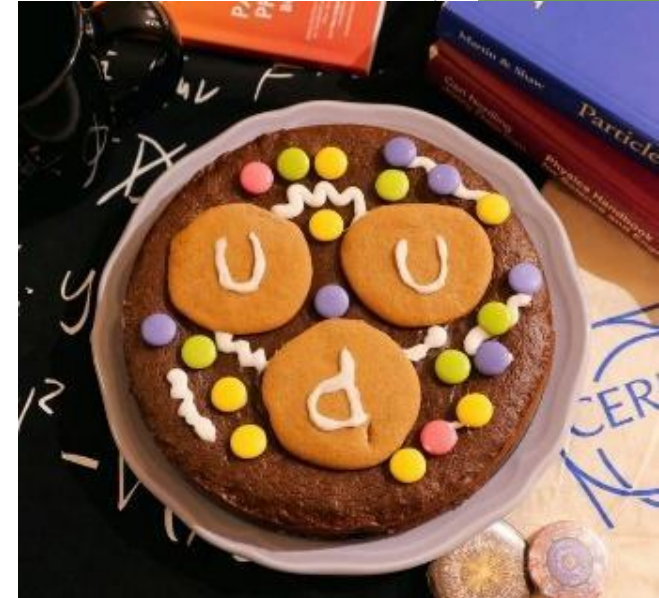
Nucleus = protons+ neutrons

Nucleons have structure too



pARTicle physics: cuisine

- ▶ Muffins modelling the nucleons
- ▶ Pizzas modelling the CERN events



pARTicle zoo: pin-cushions fermions and bosons



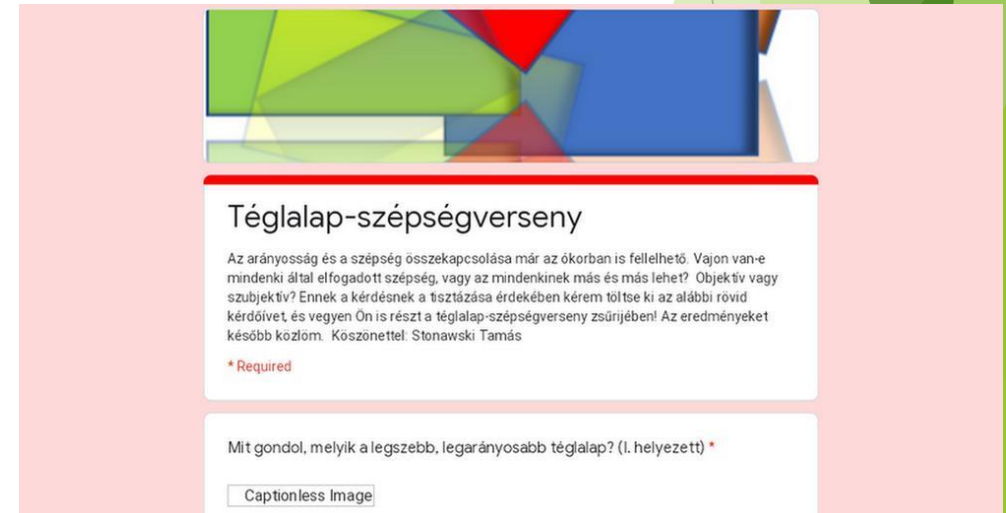
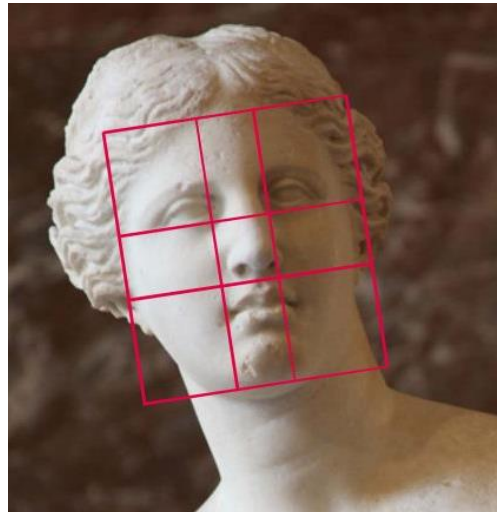
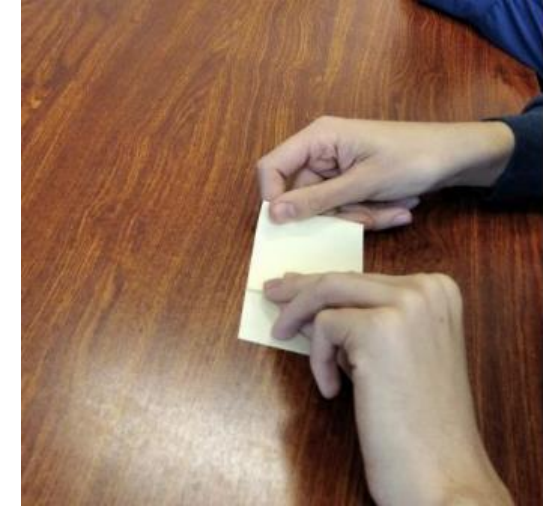
Standard Model of Elementary Particles

	Three generations of matter (fermions)			Three generations of antimatter (antifermions)			Interactions / force carriers (bosons)		
	I	II	III	I	II	III			
QUARKS	$\frac{2}{3}$ $\frac{2}{3}$ $\frac{2}{3}$ $\frac{2}{3}$ $\frac{2}{3}$ $\frac{2}{3}$ u up	$\frac{2}{3}$ $\frac{2}{3}$ $\frac{2}{3}$ $\frac{2}{3}$ $\frac{2}{3}$ $\frac{2}{3}$ c charm	$\frac{2}{3}$ $\frac{2}{3}$ $\frac{2}{3}$ $\frac{2}{3}$ $\frac{2}{3}$ $\frac{2}{3}$ t top	$-\frac{2}{3}$ $-\frac{2}{3}$ $-\frac{2}{3}$ $-\frac{2}{3}$ $-\frac{2}{3}$ $-\frac{2}{3}$ \bar{u} antiup	$-\frac{2}{3}$ $-\frac{2}{3}$ $-\frac{2}{3}$ $-\frac{2}{3}$ $-\frac{2}{3}$ $-\frac{2}{3}$ \bar{c} anticharm	$-\frac{2}{3}$ $-\frac{2}{3}$ $-\frac{2}{3}$ $-\frac{2}{3}$ $-\frac{2}{3}$ $-\frac{2}{3}$ \bar{t} antitop	$\frac{2}{3}$ $\frac{2}{3}$ $\frac{2}{3}$ $\frac{2}{3}$ $\frac{2}{3}$ $\frac{2}{3}$ g gluon	0 0 0 0 0 0 H Higgs	
	$\frac{1}{3}$ $\frac{1}{3}$ $\frac{1}{3}$ $\frac{1}{3}$ $\frac{1}{3}$ $\frac{1}{3}$ d down	$\frac{1}{3}$ $\frac{1}{3}$ $\frac{1}{3}$ $\frac{1}{3}$ $\frac{1}{3}$ $\frac{1}{3}$ s strange	$\frac{1}{3}$ $\frac{1}{3}$ $\frac{1}{3}$ $\frac{1}{3}$ $\frac{1}{3}$ $\frac{1}{3}$ b bottom	$-\frac{1}{3}$ $-\frac{1}{3}$ $-\frac{1}{3}$ $-\frac{1}{3}$ $-\frac{1}{3}$ $-\frac{1}{3}$ \bar{d} antidown	$-\frac{1}{3}$ $-\frac{1}{3}$ $-\frac{1}{3}$ $-\frac{1}{3}$ $-\frac{1}{3}$ $-\frac{1}{3}$ \bar{s} antistrange	$-\frac{1}{3}$ $-\frac{1}{3}$ $-\frac{1}{3}$ $-\frac{1}{3}$ $-\frac{1}{3}$ $-\frac{1}{3}$ \bar{b} antibottom	1 1 1 1 1 1 γ photon		
	$-\frac{1}{2}$ $-\frac{1}{2}$ $-\frac{1}{2}$ $-\frac{1}{2}$ $-\frac{1}{2}$ $-\frac{1}{2}$ e electron	$-\frac{1}{2}$ $-\frac{1}{2}$ $-\frac{1}{2}$ $-\frac{1}{2}$ $-\frac{1}{2}$ $-\frac{1}{2}$ μ muon	$-\frac{1}{2}$ $-\frac{1}{2}$ $-\frac{1}{2}$ $-\frac{1}{2}$ $-\frac{1}{2}$ $-\frac{1}{2}$ τ tau	$\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ e^+ positron	$\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ μ^+ antimuon	$\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ τ^+ antitau	0 0 0 0 0 0 Z Z ⁰ boson		
	0 0 0 0 0 0 ν_e electron neutrino	0 0 0 0 0 0 ν_μ muon neutrino	0 0 0 0 0 0 ν_τ tau neutrino	0 0 0 0 0 0 $\bar{\nu}_e$ electron antineutrino	0 0 0 0 0 0 $\bar{\nu}_\mu$ muon antineutrino	0 0 0 0 0 0 $\bar{\nu}_\tau$ tau antineutrino	1 1 1 1 1 1 W ⁺ W ⁺ boson		
	0 0 0 0 0 0 $\bar{\nu}_e$ electron antineutrino	0 0 0 0 0 0 $\bar{\nu}_\mu$ muon antineutrino	0 0 0 0 0 0 $\bar{\nu}_\tau$ tau antineutrino	0 0 0 0 0 0 ν_e electron neutrino	0 0 0 0 0 0 ν_μ muon neutrino	0 0 0 0 0 0 ν_τ tau neutrino	1 1 1 1 1 1 W ⁻ W ⁻ boson		
									0 0 0 0 0 0 W ⁰ W ⁰ boson

GAUGE BOSONS
VECTOR BOSONS
SCALAR BOSONS

Beauty, proportion and guilt edges

- ▶ Plastic rectangles
- ▶ Beauty contest for rectangles (IT use for statistics on the spot)
- ▶ Beauty contest for rectangles (facebook edition)
- ▶ The beautiful body (button+elastic band)



Téglalap-szépségverseny

Az arányosság és a szépség összekapcsolása már az ókorban is fellelhető. Vajon van-e mindenki által elfogadott szépség, vagy az mindenkinek más és más lehet? Objektív vagy szubjektív? Ennek a kérdésnek a tisztázása érdekében kérem töltse ki az alábbi rövid kérdőívet, és vegyen Ön is részt a téglalap-szépségverseny zsűrijében! Az eredményeket később közlöm. Köszönettel! Stonawski Tamás

* Required

Mit gondol, melyik a legszebb, legarányosabb téglalap? (1. helyezett) *

Captionless Image

Building a smart town (for me only excellent to know of...)

- ▶ Smart kettle
- ▶ Smart traffic lights
- ▶ Smart lightning
- ▶ Smart swithes
- ▶ Smart cameras
- ▶ Smart benches
- ▶ Smart fridges
- ▶ Smart public transport
- ▶ Etc.

Fujisawa, Japan



Also: Jagananna, India

Treasures that I have already experienced

Motivation

Inspiration

New methodological tools

Implementation

Promotion

New skills

Reinforcement

Collaboration

Cooperation

New ideas



Thank you
for your kind attention

Please, feel free to comment or ask