

Roland Eötvös: Commemorative Year

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International Conference on Precision Physics
and Fundamental Physical Constants

10–14 June 2019, Tihany

Orosz István:
Eötvös Loránd

Eötvös Loránd

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1EÖTVÖS

www.eotvos100.hu



United Nations
Educational, Scientific and
Cultural Organization

Egyesült Nemzetek
Nevelésügyi, Tudományos és
Kulturális Szervezete

100th anniversary of Roland Eötvös
(1848-1919), physicist, geophysicist,
and innovator of higher education
Commemorated in association with UNESCO

Eötvös Loránd (1848-1919) fizikus,
geofizikus és a felsőoktatás
megújítójának 100. évfordulója

Az UNESCO-val közösen emlékezve

EÖTVÖS Loránd: his Hungarian name

Roland EÖTVÖS: his international author's name

1. Family background and CV
2. Achievements: concepts and terms named after him
3. His torsion balance field survey on Balaton
4. Eötvös 100 Commemorative Year
5. A few 3D photos by Eötvös

1. Family background and CV

The Vásárosnaményi Baron Eötvös family (Bereg county, NE-Hungary)

- Great-great-grandfather: Miklós Eötvös (1716–1783): *General of the Cavalry, Baron from 1786*
- Great-grandfather: Ignác Eötvös (1763–1838): *Doctor of Arts, Royal Majesty, Under-Sheriff*
- Grandfather: Ignác Eötvös (1786–1851): *Doctor of Philosophy and Law, Treasurer Master, Vice-Chancellor*
- Father: József Eötvös (1813–1871): *Lawyer, Writer, Minister of Public Education and Religion, President of the Academy*

Father:

József Eötvös (1813–1871)



Mother:

Ágnes Rosty (1821–1913),
Daughter of Albert Rosty
(1779–1847)
Unter-Sheriff in Békés

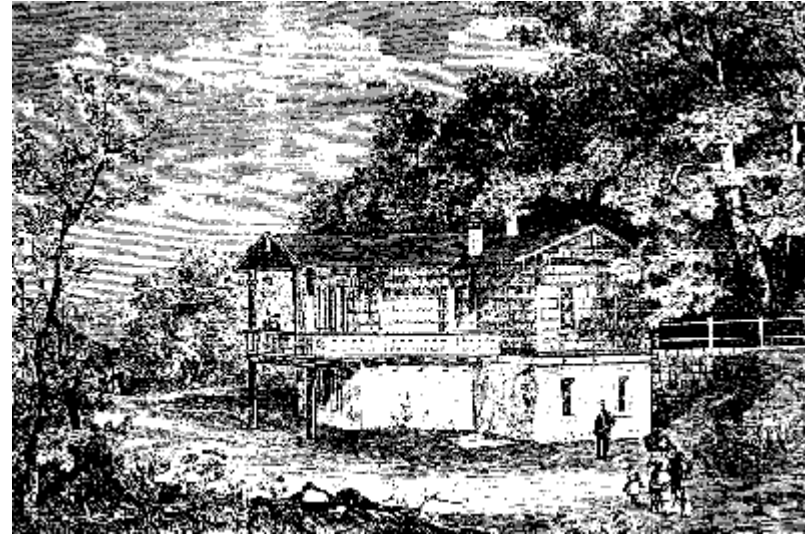


József Eötvös and Ágnes Rosty married in 1842 and had four children:

Ilona (1846–1924), Jolán (1847–1909), **Loránd (1848–1919)**, Mária (1851–1928)



József Eötvös with his son
Vasárnapi Újság (Sunday News), 1860



Loránd was born in
Buda, 27 July, 1848

„Ambition and sense of duty, which binds not only to a privileged nation, but to the whole of mankind, were born with me. To satisfy these two aspirations, and to satisfy my individual independence is my life goal; and at least so far I've found that I can answer it the most if I enter the scientific career.”

From the letter of Roland Eötvös to his father
28 March, 1866

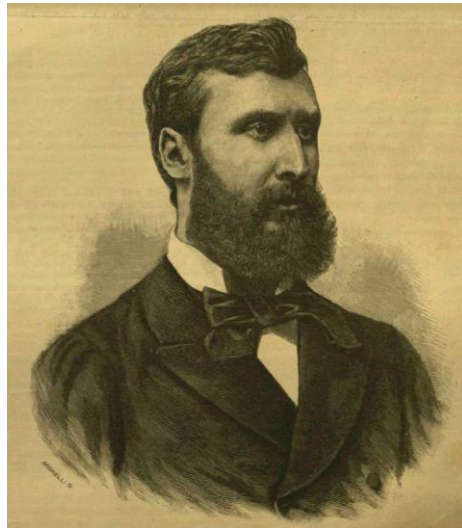
**Roland EÖTVÖS Loránd
(1848–1919)**



1858 (by Gusztáv Keleti)



Student in Heidelberg



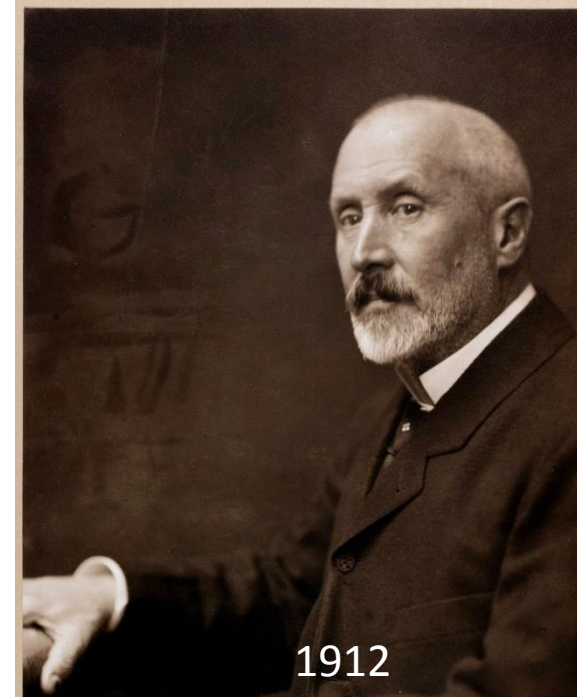
Young professor



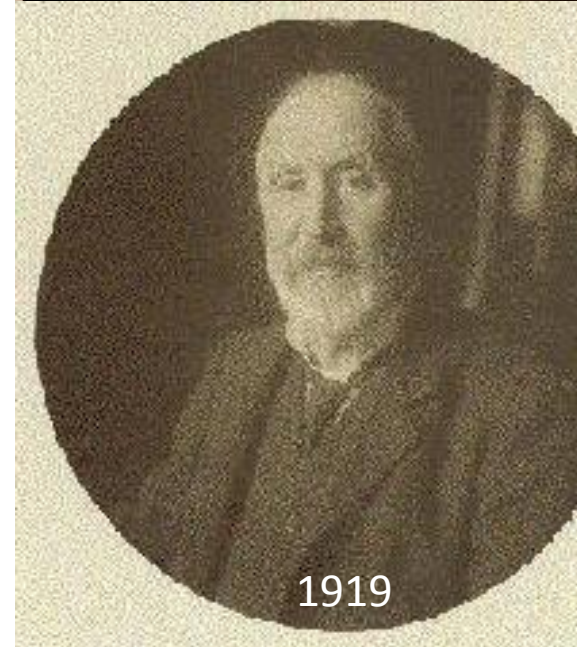
1896



1905

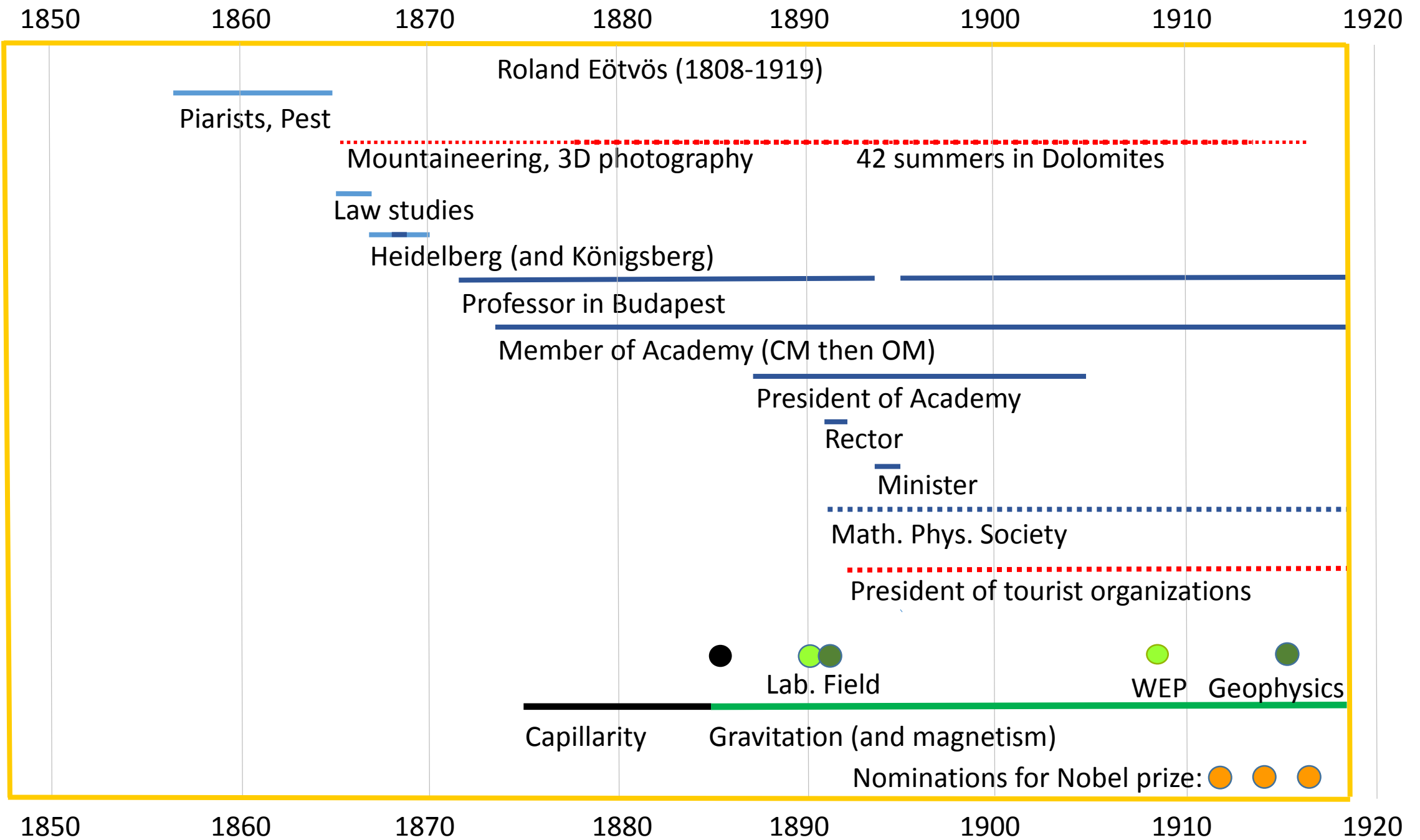


1912



1919

Married in 1876 with Gizella Horváth (1853–1919)
Daughters: Jolán (1877–1879), Rolanda (1878–1952), Ilona (1880–1945)
Eötvös did not have any grandchildren



2. Achievements: concepts and terms named after him

SCIENTIFIC CONCEPTS AND TERMS NAMED AFTER ROLAND EÖTVÖS

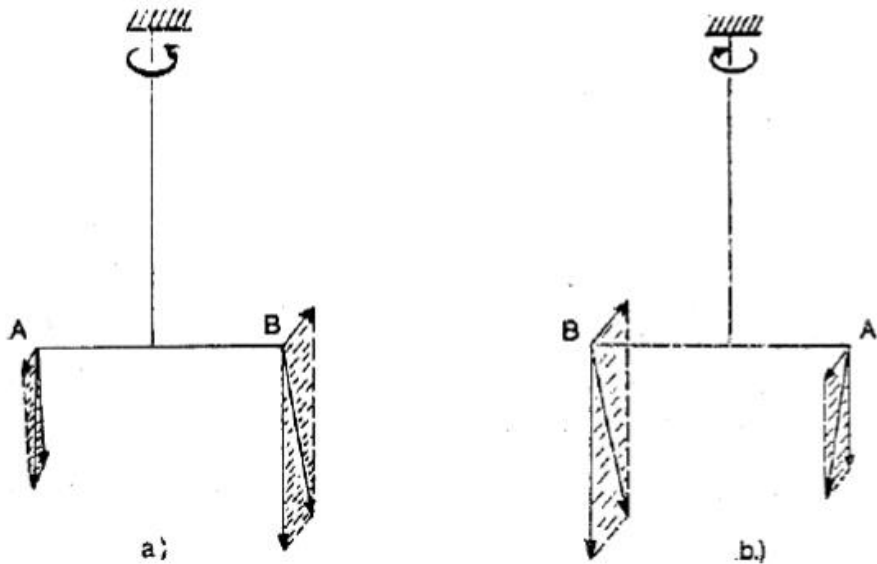
Capillarity (surface tension of liquids):	Eötvös rule (Eötvös law) Eötvös constant Eötvös number
Weak equivalence principle (inertial/gravitational mass proportionality):	Eötvös experiment (EPF or Eötvös-type experiment) Eötvös parameter
Laboratory and field instrument:	Eötvös torsion balance (Eötvös pendulum)
Geodesy:	Eötvös tensor
Gravitation on a rotating planet:	Eötvös effect Eötvös correction
Gravity and magnetism:	Eötvös law of magnetism (the Poisson-Eötvös relationship)

Eötvös's Law of Capillarity states the relationship between the surface tension of a liquid and the temperature of a liquid. In particular, we have

$$\gamma = k(T_0 - T)/\rho^{3/2},$$

where the surface tension γ (also called the capillarity constant) of a liquid is related to its temperature T , the critical temperature of the liquid (T_0), and its density ρ . The constant k is approximately the same for many common liquids such as water. Note that T_0 is the temperature at which the surface tension disappears or becomes zero.

Eötvös rule (Eötvös law)



Eötvös experiment

(EPF or Eötvös-type experiment)

$$\frac{(m_g/m_i)_1 - (m_g/m_i)_2}{[(m_g/m_i)_1 + (m_g/m_i)_2]/2}$$

Eötvös parameter

$$k=2.1 \times 10^{-7} \text{ J}/(\text{K} \cdot \text{mol}^{2/3})$$

Eötvös constant



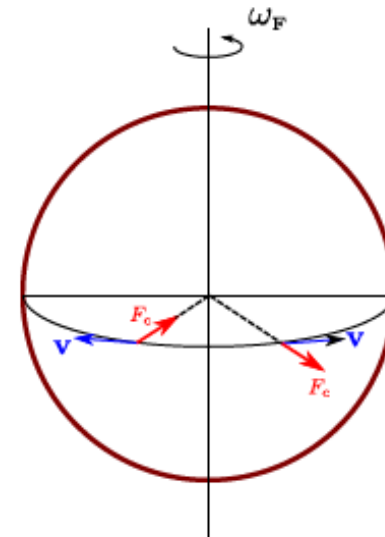
Eötvös torsion balance
(Eötvös pendulum)

Gravitational force/surface tension
Georgescu, Achard (2004): Eötvös published his results 50 years earlier than Bond; the name „Bond number” is new (1978)

Eötvös number

$$\begin{bmatrix} dg_x \\ dg_y \\ dg_z \end{bmatrix} = \begin{bmatrix} W_{xx} & W_{xy} & W_{xz} \\ W_{yx} & W_{yy} & W_{yz} \\ W_{zx} & W_{zy} & W_{zz} \end{bmatrix} \begin{bmatrix} dx \\ dy \\ dz \end{bmatrix}$$

Eötvös tensor



Eötvös effect
Eötvös correction

Terrestrial Magnetism
and
Atmospheric Electricity

VOLUME XXVI SEPTEMBER, 1921 NUMBER 3

R. DE EÖTVÖS' LAW CONCERNING THE CONNECTION BETWEEN THE LOCAL DISTURBANCES OF THE MAGNETIC FORCE AND THOSE OF GRAVITY.

Eötvös law of magnetism
(the Poisson-Eötvös relationship)

Physical unit

eötvös (unit)

The eötvös (or eotvos, E): unit of acceleration divided by distance. $1 \text{ eötvös} = 1 \text{E}=10^{-9} \text{ s}^{-2}$

Nature forms named after Roland Eötvös

Mineral

Lorándite

Lorándite is a mineral (thallium arsenic sulfosalt, 1894), being used for detection of solar neutrino

Mountain peak

Eötvös Peak (Cima di Eötvös, Eötvösspitze)

The Eötvös Peak is the second highest, or south-western Cadin peak in the Dolomites (2837 m)

Routes, caves etc.

Via Eötvös (≠Via Eötvös Dimai)

First climbing route of Croda da Lago. (Via Eötvös Dimai is named after his daughters.)

Eötvös-út (Eötvös Loránd-turistaút, Etveska, Eötvösova cesta)

A hiking trail above Banská Stiaavnica (Selmečbánya, Schemnitz), named after Roland Eötvös (1896)

Eötvös caves

Aggtelek Karstic Mts; and Krecsunesd / Crăciunești (Șura de Sus)

Moon crater

Eötvös crater

The Eötvös crater is the remains of a lunar impact crater on the far side of the Moon. It lies to the north-northwest of the walled plain Roche, and east-southeast of the equally ruined Bolyai.

Asteroid

12301 Eötvös

12301 Eötvös is a main belt asteroid with an orbital period of 3.65 years (1991).

3. The first field survey by using torsion balance: the Balaton measurements



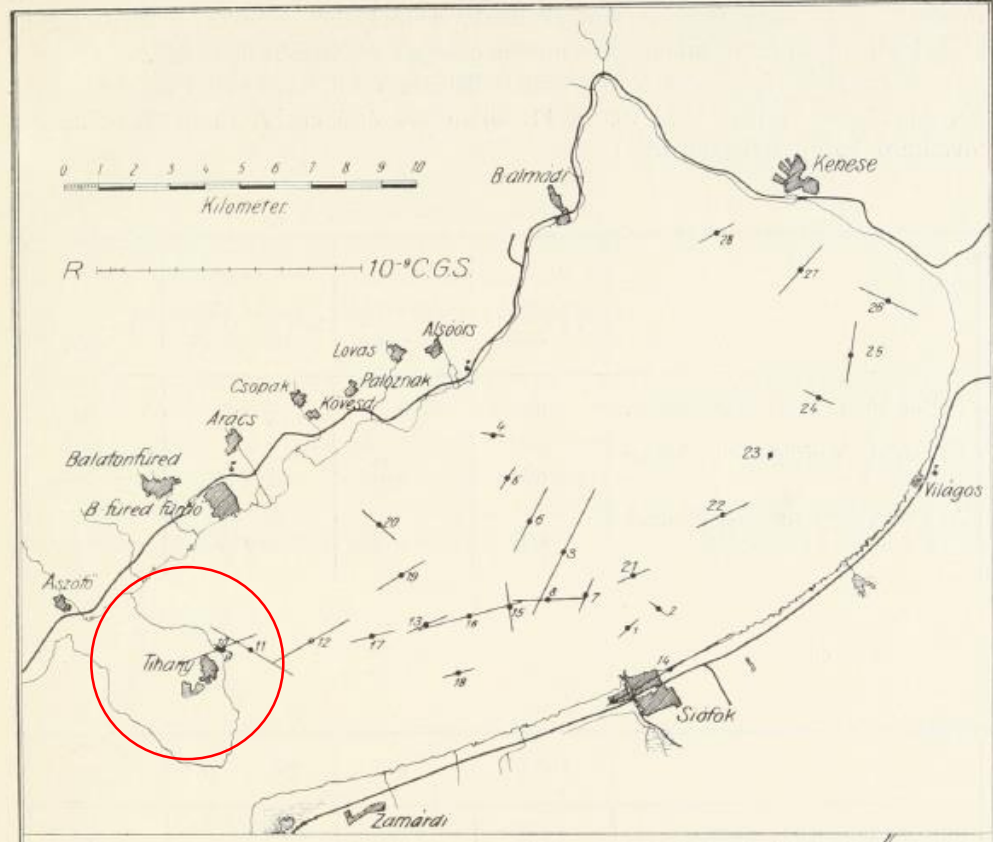
The „Balaton” torsion balance

History:

1. 1891: the first field experiment by using the prime (laboratory version) Eötvös torsion balance (Ság hill)
2. The field version of the torsion balance became ready in 1898 (known as the „Balaton” balance)
3. The frozen Balaton (in 1901 and 1903) offered an ideal test area

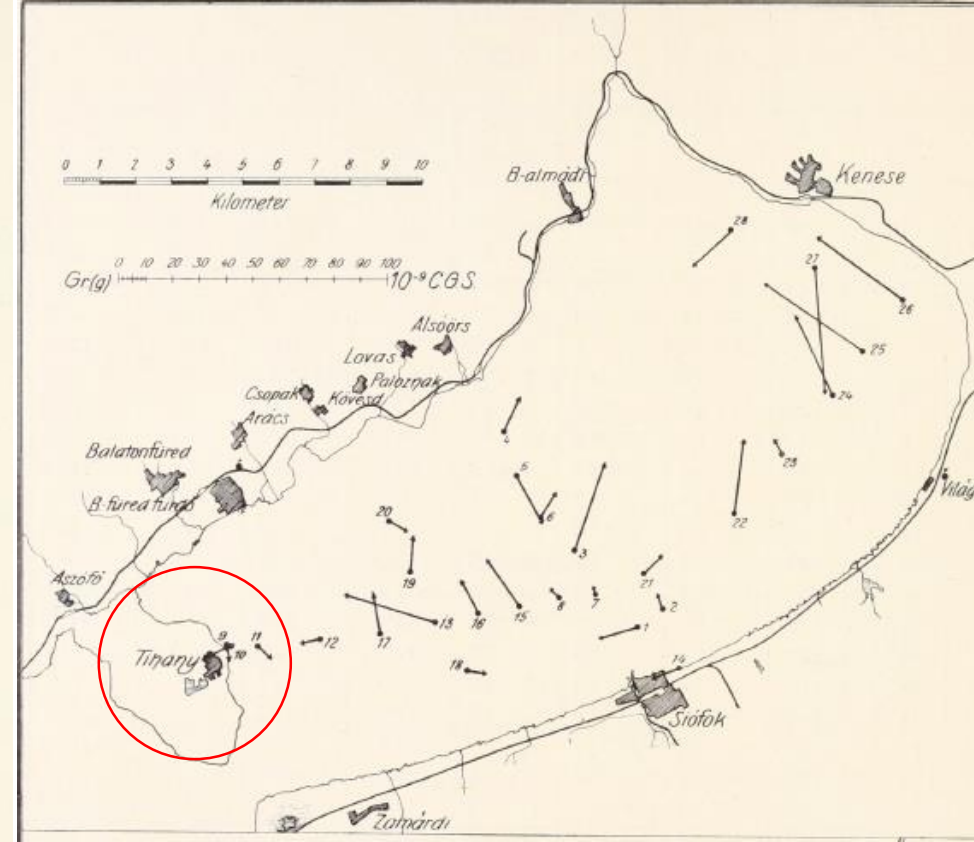
„Deviating force” R of subsurface origin

Az R irányítóképességei subterrán rendellenességei.



Gradients of subsurface origin

A gradiensek subterrán rendellenességei.



“...the gradients perpendicular to the axis of the Balaton and the deviating forces parallel to the axis indicate a tectonic line in this direction”

Eötvös (1908)

Politisches Volksblatt.

28. Jahrgang Nr. 14. Erscheinungstag: Freitag, 14. März 1901. Preis: 10 Pfennig. (Inhalt: 10 Seiten.) (Gesamtpreis, 10, Sechser 60.)
 Verlag: J. Neumann, Neudamm, bei Berlin.
 Redaktion: J. Neumann, Neudamm, bei Berlin.
 Druck: J. Neumann, Neudamm, bei Berlin.

Zwei ungarische Gelehrte in Lebensgefahr.



„Two Hungarian scientists in danger of life”

4. Eötvös 100 Commemorative Year (more than 100 events through 2019, Hungary and abroad)



Wreath laying ceremony
Budapest, 2019.04.09.



Eötvös 100 Commemorative Day
Budapest, 2019.04.08.



Budapest, 2019.04.09.: thanksgiving mess

Eötvös 100 exhibition at the EGU 2019 in Vienna
(with 3D stereoscopic photos by Eötvös and the „doubled” torsion balance)



Jonathan Bamber
President, EGU



Sierd Cloetingh
President, AE



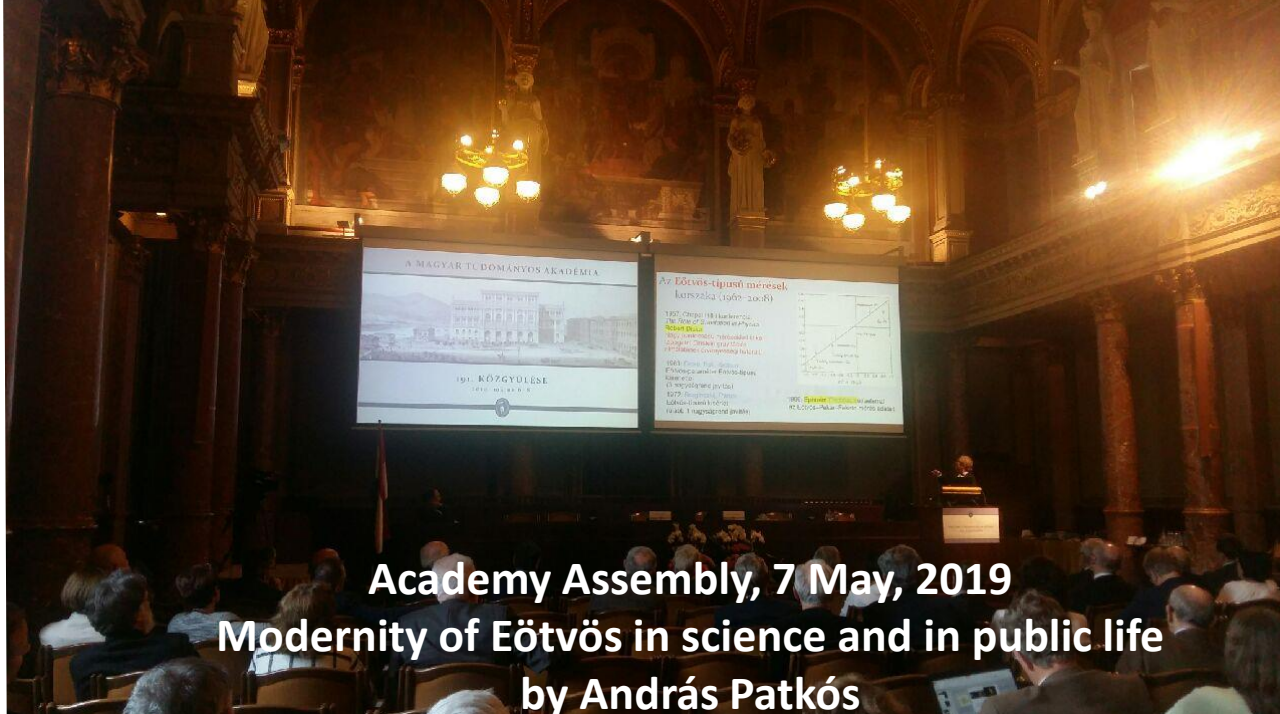
Robin Elisabeth Bell
President, AGU



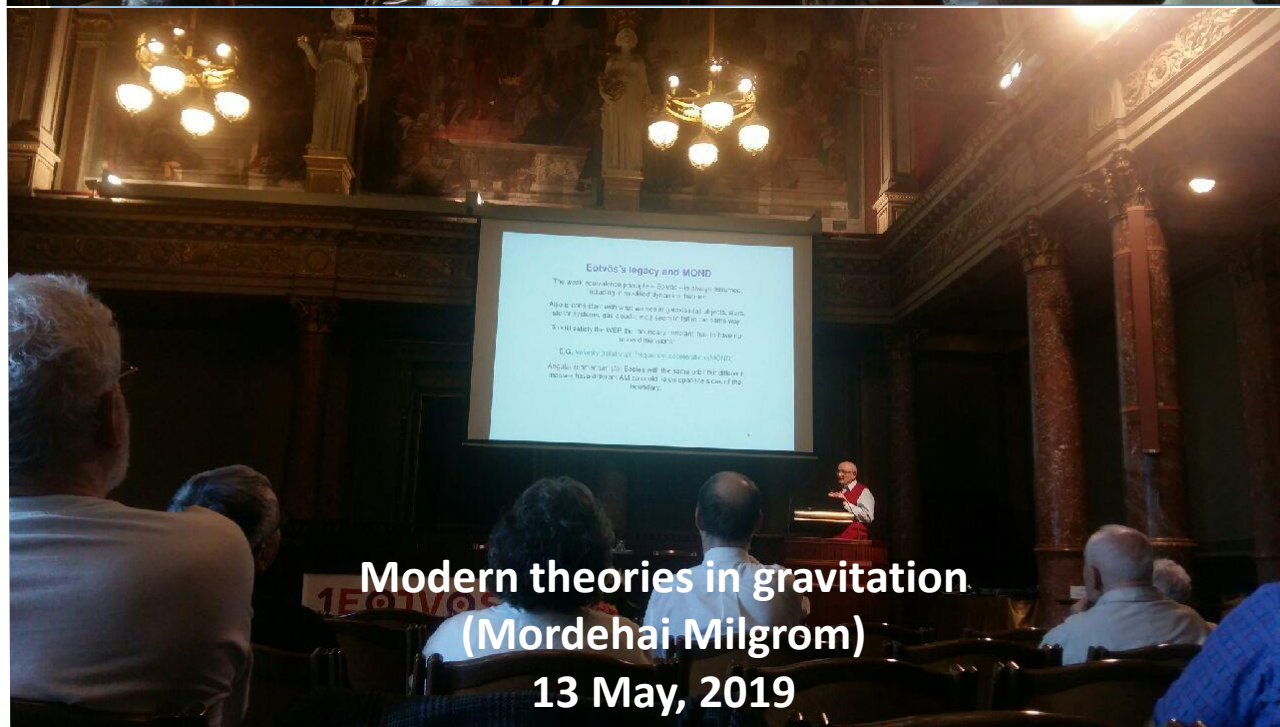
Alik Ismail-Zadeh
SG, IUGG



**Eötvös Loránd National Science Competition
Final: Ság hill (Celldömölk, 11-12 May, 2019)**



**Academy Assembly, 7 May, 2019
Modernity of Eötvös in science and in public life
by András Patkós**



**Modern theories in gravitation
(Mordehai Milgrom)
13 May, 2019**

5. A few 3D photos by Eötvös, digitally converted on the occasion of the Commemorative Year

Take the red-cyan glasses on (red: left side)

1EÖTVÖS

Digitally converted
3D anaglyph photo
by Eötvös

Budapest
Múegyetem rakpart
appr. 1890

Conversion:
Zsolt Regály
Konkoly Observatory



2019

Digitally converted
3D anaglyph photo

Fruska Gora, Titel, 1902

Conversion:
Zsolt Regály
Konkoly Observatory



Digitally converted
3D anaglyph photo

Balaton (1901 or 1903)

Conversion:
Zsolt Regály
Konkoly Observatory



Digitally converted
3D anaglyph photo

Balaton (1901 or 1903)

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Conversion:
Zsolt Regály
Konkoly Observatory



Digitally converted
3D anaglyph photo

Dolomites

Conversion:
Zsolt Regály
Konkoly Observatory

More 3D photos:
www.eotvos100.hu



Digitally converted
3D anaglyph photo

Dolomites

Conversion:
Zsolt Regály
Konkoly Observatory

More 3D photos:
www.eotvos100.hu



Baron Eötvös' truths on gravitational force and surface tension will remain in a thousand years as true and valuable they are today, even when our actual concepts for the gravity and for the smallest parts of the matter would happen to be eliminated. ”

Sándor Mikola, 1929

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geofizikus és a felsőoktatás
megújítójának 100. évfordulója**

Az UNESCO-val közösen emlékezve

„So, finally, we must rest assured that science does not give the true explanation of natural phenomena, but only leads to the border where the elusive begins.”

Eötvös, 1877