

Higher Education in Hungary

Sándor Katz

Institute for Theoretical Physics
Eötvös University

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Some facts about Hungary

- Population: **9.9 million**
- GDP (2012): **98 billion EUR**
- GDP per capita (2012): **9800 EUR**
- national budget (2013): **55 billion EUR**
redistribution **> 55 %**
- R&D expenditure: **1.2% of GDP**
- Hungarian Academy of Sciences: **0.15% of GDP = 147M EUR**
 - Hungarian Scientific Research Fund (OTKA): **26M EUR**
 - "Momentum" (Lendület) Grants: **10.5M EUR**
- Higher Education: **0.5% of GDP = 490M EUR**

Elementary and Secondary education

- Students spend 12 years in elementary and high schools
- different choices (8+4, 6+6, 4+8)
- Many high schools offer advanced level physics and mathematics courses
- $\mathcal{O}(10)$ students finish high school every year with excellent mathematics and physics background
excellent results in maths and physics international competitions
- even at this age talented students often choose foreign universities

Higher Education

- **68!** Institutions (Hungarian Accreditation Committee)
- Funding mostly normative (proportional to number of students)
- Plans for 60-30-10 funding
 - **60%** normative
 - **30%** based on output
 - **10%** based on excellence
- present funding level only for basic functions
research can only be supported from external grants
- some extra funding (**34M EUR**) for research and elite Universities
- 6 research Universities: **BME, DE, ELTE, PTE, SOTE, SZTE**
- 3 elite Universities: **U. of Debrecen (DE), Eötvös (ELTE), U. of Szeged (SZTE)**

Physics at Hungarian Universities

- Bologna system
- **3 years** → BSc, **2 years** → MSc
- since 2013: **unified 5-year education for teachers**
- **5 Universities** offer physics up to PhD level (two in Budapest, Debrecen, Pécs, Szeged).
- **HEP** mostly at three Universities (Technical University (BME), Eötvös (ELTE), U. of Debrecen(DE))
- Main profile for Pécs and Szeged is laser physics → ELI

Physics BSc at Eötvös University

- 100-150 students start every year
116 students in 2013, 153 at the other four Universities
- first two semesters: Foundation courses (mostly mathematics: Calculus, vector algebra+calculus, diff. equations, etc.)
- two levels (A and B) of theoretical physics courses.
The higher level courses are:
Theoretical Mechanics (4+2)
Electrodynamics (4+2)
Quantum Mechanics (4+2)
Statistical physics (4+2)
- similarly two levels (A,B) for higher mathematics and informatics
- specialization happens at the fifth semester
- ≈ 30 students choose 'Physicist'
- Introductory HEP courses in the last semester

Physicist MSc at Eötvös University

- **21** students started this year
(BSc mostly from Eötvös or Technical U.)
- students have to choose from 7 Specialization Modules:
 - Astrophysics
 - Biological Physics
 - Materials Physics
 - Atomic and Molecular Physics
 - Particle Physics
 - Statistical Physics
 - Solid State Physics
- students have about a year for the diploma thesis
- many of them have publications before receiving their MSc

Particle Physics Module

- Theory dominated
- Compulsory courses:
 - Quantum Electrodynamics 1
 - Strong Interaction at Low Energies
 - Experimental Methods in Particle Physics
 - Quantum Electrodynamics 2
 - Quantum Chromodynamics
 - Weak Interactions
- Particle Physics and Nuclear Physics labs
- Half of the credits come from freely chosen courses
 - Renormalization
 - Lattice gauge theory
 - String theory
 - Finite temperature field theory
 - etc.

PhD studies at Eötvös University

- Unfortunately the best students often seek foreign PhD studies
- 3 PhD programs:
 - Materials and Solid State Physics
 - Particle Physics and Astronomy
 - Statistical Physics, Biological Physics and Physics of Quantum Systems
- around 15 students start the Physics PhD school every year with a state scholarship, 3-4 in Particle Physics
- similar number of students without scholarship, usually employed at institutions of the Academy
- Credits are collected from four compulsory courses + freely chosen ones
- PhD students have 2-4 hours weekly teaching duties
- Scholarship is for 36 months, getting the PhD degree usually takes longer

PhD studies in Particle Physics

- Compulsory courses:
 - Advanced Field Theory
 - Standard Model
 - Beyond the Standard Model
 - Experimental High Energy Physics
- Large selection for freely selected courses:
 - Completely integrable field theories
 - String Theory
 - Algebraic quantum field theory
 - Solitons and instantons
 - etc.
- **Two peer-reviewed publications** are required for the PhD degree

PhD degrees awarded in the past years

about 50% of PhD students receive a degree

	2012	2011	2010	2009
all	34	41	49	37
Eötvös	15	15	23	18
all HEP	4	4	4	3
Eötvös HEP	1	3	3	2

Career opportunities at Hungarian Universities

- four types of positions, all of them (almost) permanent
 - **Teaching Assistant**
MSc required. Has to obtain PhD within 8 years
 - **Assistant Professor**
PhD required. Has to work on Habilitation
 - **Associate Professor**
PhD and Habilitation required
 - **Full Professor**
PhD and Habilitation required
- postdoctoral system **almost non-existent**
OTKA has limited postdoctoral funding
recently new postdoctoral calls by the Academy
- people usually enter at TA or Assistant Prof. level and then advance up

Research at Hungarian Universities

- HEP research will be discussed in separate talks
- Funding almost exclusively from grants
 - **OTKA grants:**
typically around 100k EUR for 4 years
117 running physics grants, 20 HEP
 - **ERC grants**
17 Starting Grants & 14 Advanced Grants total since 2007
5 physics StG 3 at Universities, 1 HEP
1 physics AdG 1 at Universities, 0 HEP
 - **"Momentum" (Lendület) grants**
Started in 2009 for Institutes of the Academy
Available for Universities since 2011
Similar to ERC, up to 1M EUR for establishing new group
So far **79 (32)** grants (at Universities), **16 (6)** physics, **5 (2)** HEP
- The Academy supports research groups at Universities
2 HEP research groups Debrecen & Eötvös