

Theoretical physics

in the Czech Republic

Astrophysics, nuclear & particle physics: a brief overview

Jiří Hořejší

Institute of Particle and Nuclear Physics
Faculty of Mathematics and Physics, Charles University Prague

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Institutions

4 Universities and 3 institutes of ASCR (\equiv Academy of Sciences of the Czech Republic)

Charles University (Prague, founded 1348)
Institute of Particle & Nuclear Physics
Institute of Theoretical Physics
Astronomical Institute

Czech Technical University (Prague, f.1803)
Faculty of Nuclear Science and Engineering,
Department of Physics

Institute of Physics ASCR (Prague, f.1950s)
Division of Elementary Particle Physics

Astronomical Institute ASCR
(Ondřejov/Prague, f.1950s)

Nuclear Physics Institute ASCR (Řež/Prague, f.1950s)
Division of Theoretical Physics

Masaryk University (Brno, f.1919)
Institute of Theoretical Physics and Astrophysics

Silesian University (Opava, f.1990)
Institute of Physics

Topics and statistics of the community

Astrophysics, relativity and gravitation

Topics covered:

Exact and numerical solutions of Einstein equations, gravity in higher dimensions, physics of black holes, models of accretion discs.

Analysis of observational data from ESO, Pierre Auger Observatory and H.E.S.S., spectroscopy and photometry of binary stars, celestial mechanics, dynamics of solar system, solar and stellar physics.

Further specific topics possibly related to astrophysics: Electron scattering on composite systems (molecules in particular).

Institutions: Charles University, Astronomical Institute ASCR, Masaryk University

Numbers: 45 researchers with at least Ph.D., about 30 Ph.D. students

Tradition: Starting from Tycho de Brahe and Kepler, through Doppler and Mach to Einstein, ...

Topics and statistics of the community

Nuclear physics

Topics covered:

Theory of deformed nuclei (microscopic description of the collective motions), fast rotating nuclei, classical and quantum chaos, quantum phase transitions in nuclei and mesoscopic systems, reactions with light nuclei, few-nucleon systems, algebraic models for nuclear structure (e.g. IBM model, symmetries), physics of hypernuclei, relativistic methods for nuclei, mesonic exchange currents.

Institutions: Charles University, Czech Technical University, Nuclear Physics Institute

Numbers: 15 researchers with at least Ph.D., 5 Ph.D. students

Tradition: Since the early 1950s

Topics and statistics of the community

Particle physics

Topics covered:

Electroweak theory, effective Lagrangians (in particular, chiral perturbation theory for mesons), QCD theory and phenomenology, hadron phenomenology, sigma models in curved backgrounds, colour superconductivity in QCD, noncommutative field theory, string theory, methods in gauge field theory.

Institutions: Charles University, Czech Technical University, Institute of Physics ASCR, Nuclear Physics Institute ASCR, Masaryk University, Silesian University

Numbers: 25 researchers with at least Ph.D., 15 Ph.D. students

Tradition: Since the early 1950s

National and European networks

National ,networks‘:

„Research centres“ – complex projects funded by the Ministry of Education, forming „networks“ of research groups belonging to different institutions, typical duration 5 years (renewable)

In particular: 1) **Centre for particle physics**

(Charles Univ., Inst. of Physics ASCR, Czech Technical Univ.).

Started 2000, includes *both* experimental *and* theoretical particle physics

2) **Centre for theoretical astrophysics**

(Astronomical institute ASCR, Charles Univ., Silesian Univ. Opava).

Started 2006

European networks:

A group of theorists from Charles University (IPNP) working on chiral perturbation theory is integrated into the European network **„Flavianet“** (formerly „Euridice“ and „Eurodaphne“). The Prague group (about 5 people including Ph.D. students) belongs to the Marseille subnode.

Note:

„Flavianet“ is a Marie Curie Research Training Network, contract No. MRTN-CT-2006-035482, Spain-UK-Germany South-Italy-Poland-Nordic-France-Germany Nord-Austria-Switzerland

A recent highlight in the European context:

The so-called EURYI Award for a young Czech researcher (M. Schnabl, currently at the IAS, Princeton), who is supposed to form a new research group in Prague, oriented to string theory and quantum gravity, starting in summer 2008

Funding

Institutional funding:

Mostly through the long term (5 – 7 years) broader projects, the so-called ‚research plans‘, funds provided by the Czech Ministry of Education or the Academy of Sciences of the Czech Republic.

Institutional funding covers essentially the salaries, as well as a minor part of the operation costs related to the research.

Other sources:

- 1) National networks (‚research centres‘) may provide quite substantial part of the operation costs (in particular, travelling, inviting guests, etc.) and may be also used for covering the salaries of young postdocs. Funds allocated to the research centres can also cover activities in Ph.D. education (summer schols, intensive courses).
- 2) Special research grants of the Ministry of Education for international collaboration, the so-called INGO projects (CZ participation in the Pierre Auger Observatory is one of them).
- 3) Last but not least, there are ‚small-scale‘ research grants from GACR (Grant Agency of the Czech Republic, the ‚Czech Science Foundation‘) that involve typically 3 – 10 people. There are even individual grants for postdocs.