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Open session of the 2015 R-ECFA meeting in Prague

CR particle theory

Michal Malinský

IPNP, Charles University in Prague

- Institutions, researchers
- Research topics, collaboration networks
- A bit of scientometry
- International schools and courses
- Funding
- Summary and outlook



GERMANY

P O L A N D

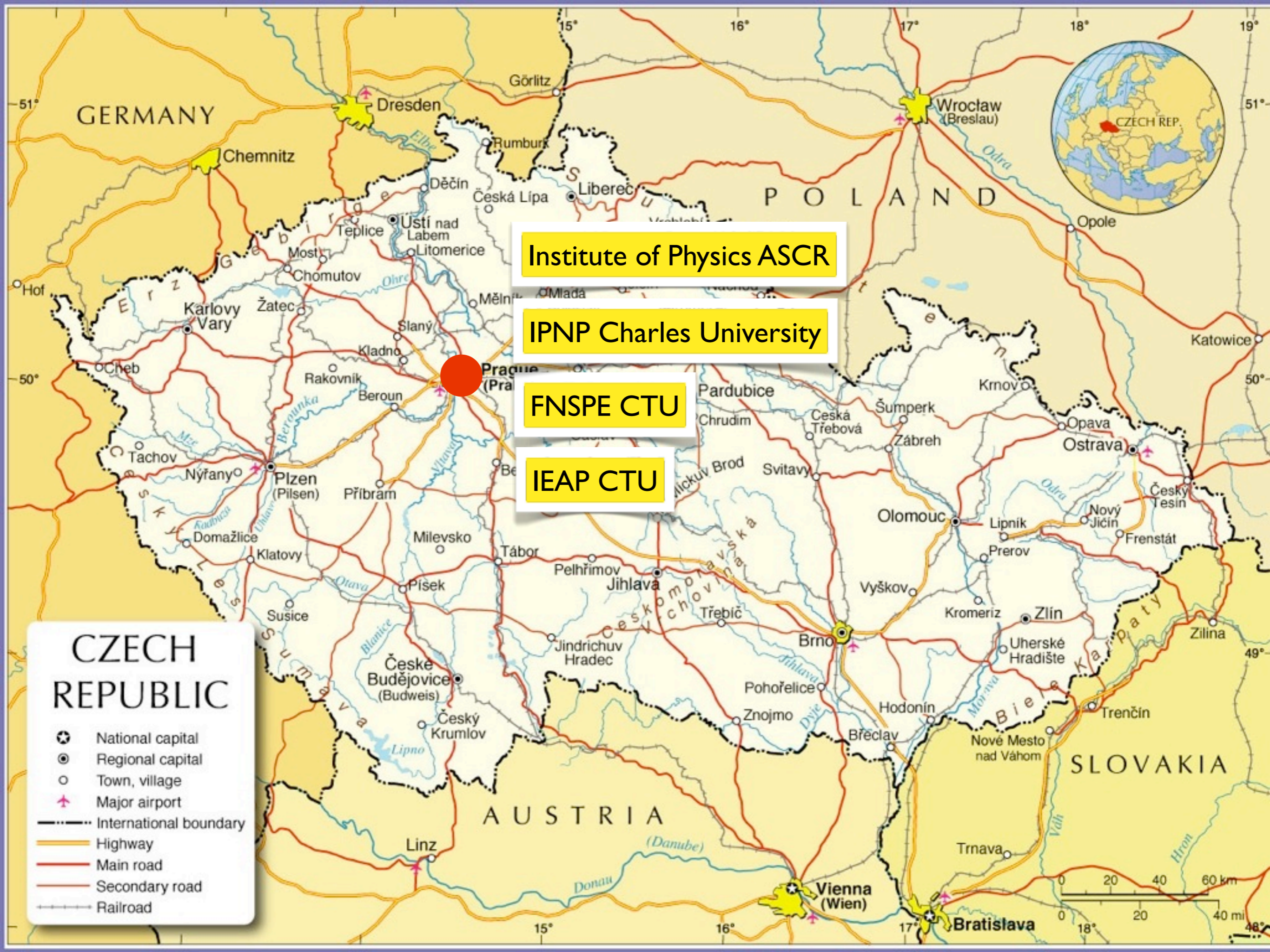
A U S T R I A

S L O V A K I A

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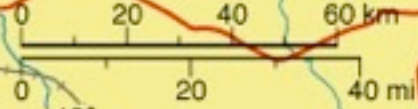
IPNP Charles University

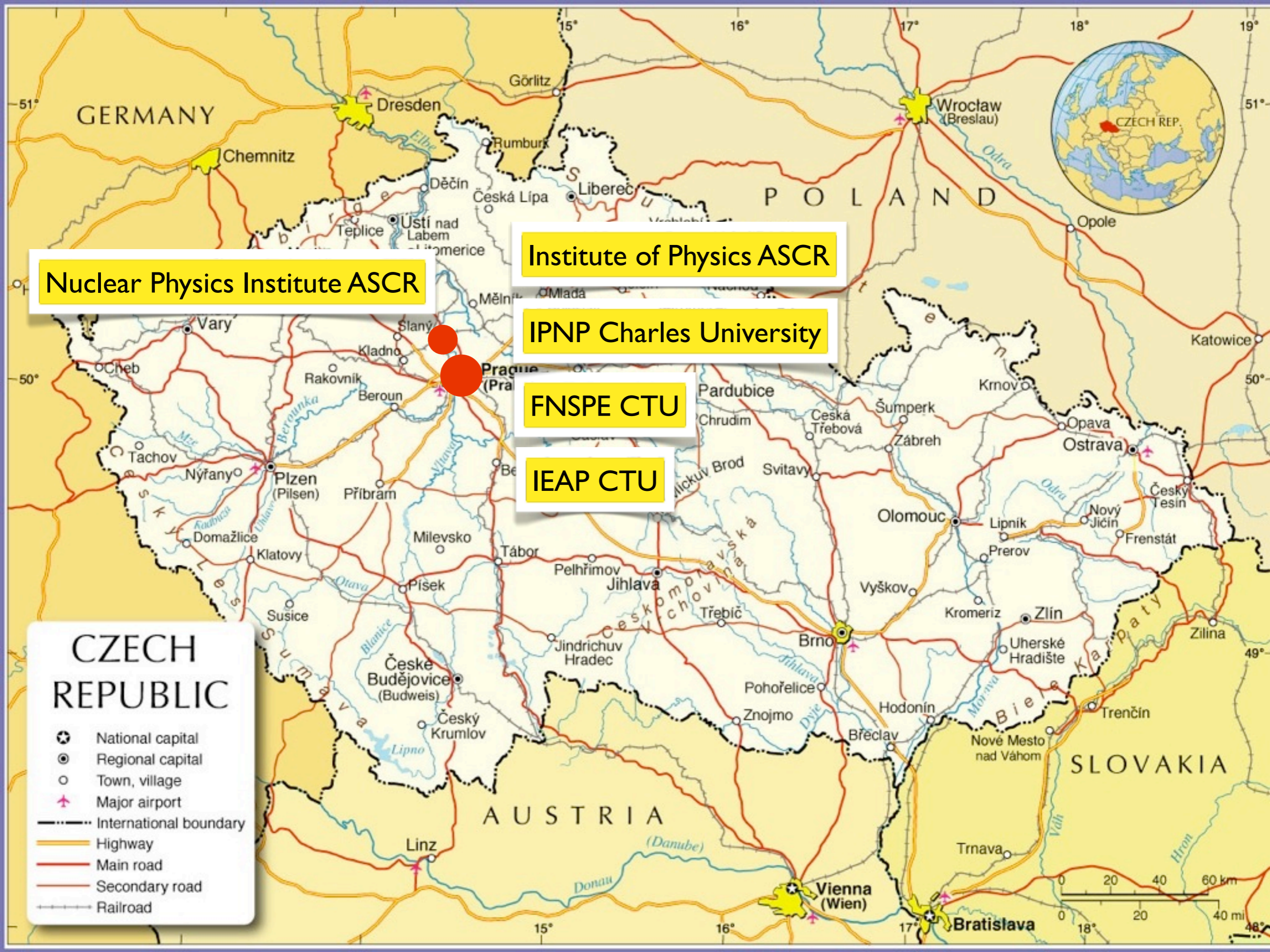
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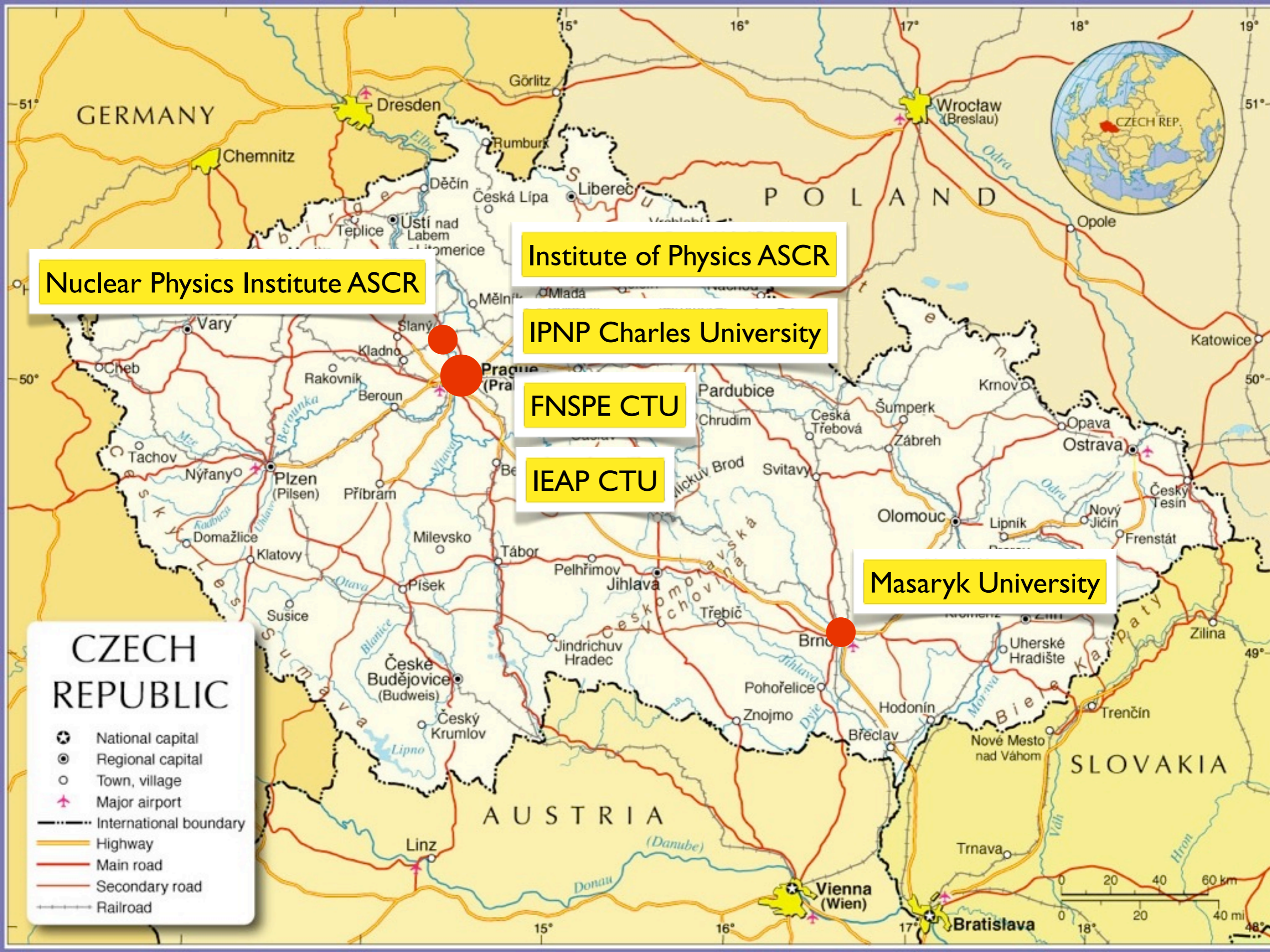
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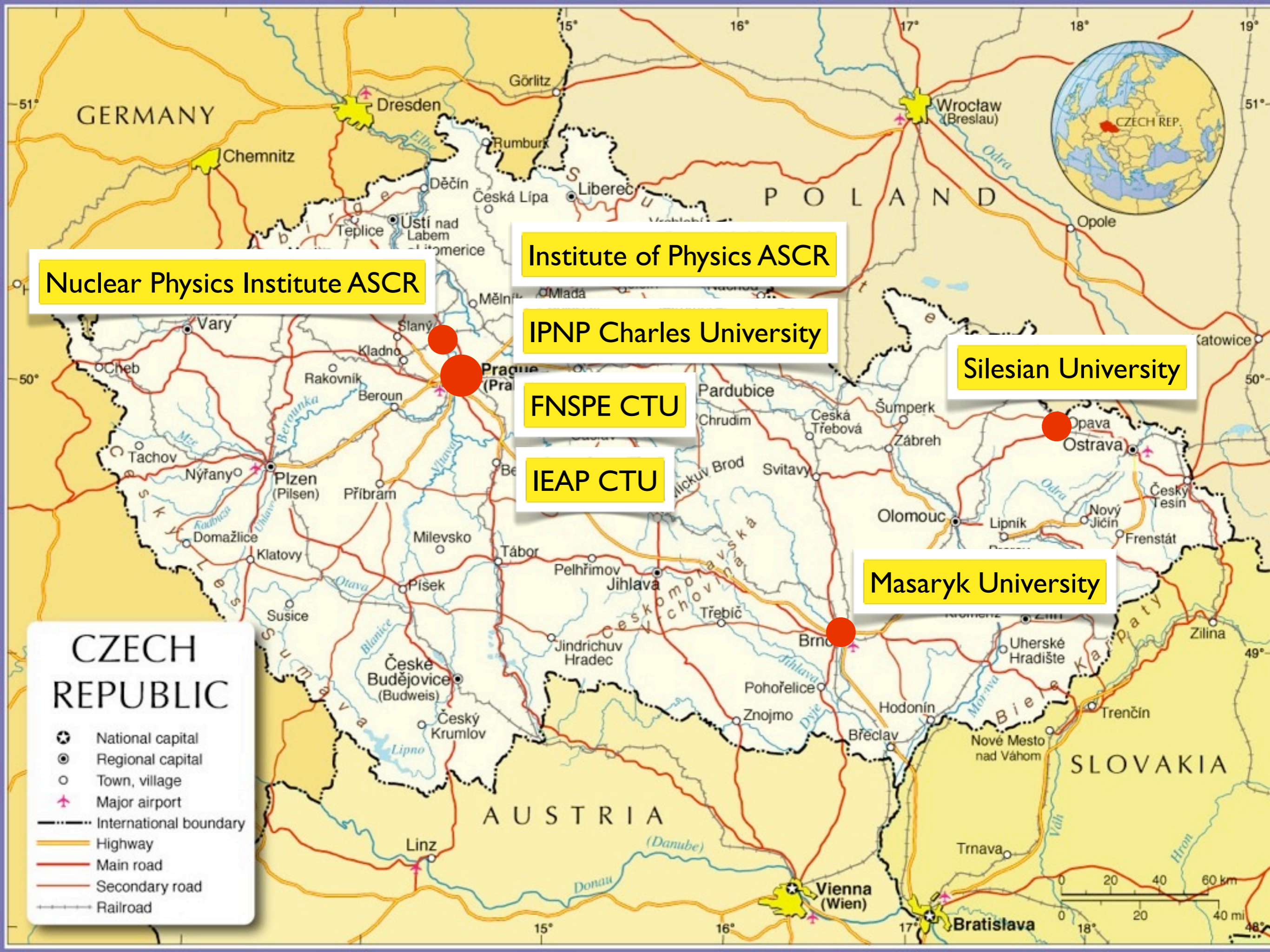
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Silesian University

Masaryk University

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PT institutions & researchers

	Ph.D.s	students
Institute of Physics ASCR	8(1) or* 13(6)	2 or* 3
IPNP Charles University	7(3) or* 8(4)	4
Nuclear Physics Institute ASCR	4(2) or* 10(5)	about 4, mostly in MP
IEAP Czech Technical University	4(2) or* 5(3)	O(1)
FNSPE Czech Technical University	3(3) or* 7(5)	many, mostly in MP
Masaryk University in Brno	2(2) or* 5(5)	2 or* 3
Silesian University in Opava	2(1) or* 4(2)	1 or* 2

(#) stands for foreigners or people with extended foreign (western) experience

*“or” stands for counts including adjacent fields (strings, mathematical physics, QGR etc.)

- Precise headcount difficult (overlaps, part-time, fuzzy borderlines, fluctuation)
- The numbers **have increased** (even for just “pure PT” part)
- **# of foreigners/researchers with ext. western experience increasing**
- **# of “young” Ph.D.’s increasing, we are becoming post-doc attractive!**

Research topics, publications, collaborations

Institute of Physics ASCR

QCD theory and phenomenology, phenomenology of elastic hadron scattering, symmetries in field theory, [string theory and quantum gravity \(SFT, conformal methods\)](#)

- **Probing new physics in diphoton production with proton tagging at the Large Hadron Collider**
S. Fichet (IIP, Brazil), G. von Gersdorff (Sao Paulo), [O. Kepka](#) et al., Phys.Rev. D89 (2014) 11, 114004
- **Phenomenological models of elastic nucleon scattering and predictions for LHC**
J. Kaspar (CERN), [V. Kundrať](#), [M. Lokajicek](#), Jiri Prochazka (CERN), Nucl.Phys. B843 (2011) 84-106
- **The relation between TMDs and PDFs in the covariant parton model approach**
A.V. Efremov (Dubna), P. Schweitzer (Connecticut U.), O.V.Teryaev (Dubna), [P. Zavada](#), Phys.Rev. D83 (2011) 054025
- **Expansion functions in perturbative QCD and the determination of $\alpha_s(M_{\tau}^2)$**
I. Caprini (Bucharest, IFIN-HH), [Jan Fischer](#), Phys.Rev. D84 (2011) 054019
- **Multibrane Solutions in Open String Field Theory**
[M. Murata](#) (Prague, Inst. Phys. & Wako, RIKEN), [Martin Schnabl](#), JHEP 1207 (2012) 063
- **Open superstring field theory I: gauge fixing, ghost structure, and propagator**
M. Kroyter (Tel Aviv), Y. Okawa (Tokyo U), [M. Schnabl](#), S. Torii (Tokyo U), B. Zwiebach (MIT), JHEP 1203 (2012) 030

Research topics, publications, collaborations

IPNP Charles University

Electroweak theory, effective Lagrangians (chiral perturbation theory), [beyond Standard Model phenomenology](#) (neutrinos, SUSY, baryon and lepton number violation), advanced methods in the quantum field theory (amplitudes)

■ **Leading logarithms in the anomalous sector of two-flavour QCD**

J. Bijnens (Lund U.), [K. Kampf](#), S. Lanz (Lund U.) Published in Nucl.Phys. B860 (2012) 245-266

■ **Analytical dispersive construction of $\eta \rightarrow 3\pi$ amplitude: first order in isospin breaking**

[K. Kampf](#) (Lund U. & Charles U.), M. Knecht (Marseille), [J. Novotny](#), [M. Zdrahal](#), Phys.Rev. D84 (2011) 114015

■ **Proton lifetime in the minimal $SO(10)$ GUT and its implications for the LHC**

[H. Kolečová](#) (IPNP & Prague, Tech. U.), [M. Malinský](#), Phys.Rev. D90 (2014) 11, 115001

■ **Non-standard antineutrino interactions at Daya Bay**

[R. Leitner](#), [M. Malinsky](#) (Valencia), [B. Roskovec](#), H. Zhang (Heidelberg), JHEP 1112 (2011) 001

■ **Mixing-induced Spontaneous Supersymmetry Breaking**

A. Capolupo, Marco Di Mauro (DMI & INFN, Salerno & Prague, Tech. U.), [A. Iorio](#), Phys.Lett.A375 (2011) 3415-3418

■ **Weyl-Gauge Symmetry of Graphene**

[A. Iorio](#), Annals Phys. 326 (2011) 1334-1353

Research topics, publications, collaborations

Nuclear Physics Institute ASCR

Advanced quantum mechanics, non-perturbative aspects of QFT, color superconductivity in QCD, spontaneously broken symmetries, hadron phenomenology, exotic nuclei, [dynamical breaking of the electroweak symmetry](#), [LHC phenomenology](#), [supersymmetry](#)

■ **Fundamental length in quantum theories with PT-symmetric Hamiltonians**

[Miloslav Znojil](#), Phys.Rev. D80 (2009) 045022

■ **Solving the Bethe-Salpeter equation for a pseudoscalar meson in Minkowski space**

[V. Sauli](#), J.Phys. G35 (2008) 035005

■ **Spontaneous Symmetry Breaking and N-G Bosons in Quantum Many-Body Systems**

[Tomas Brauner](#), Symmetry 2 (2010) 609-657

■ **Massive Nambu-Goldstone Bosons**

H.Watanabe (Berkeley), [Tomáš Brauner](#), H. Murayama (Berkeley, Tokyo U.), Phys.Rev.Lett. 111 (2013) 2, 021601

■ **On saturation of charged hadron production in pp collisions at LHC**

M.V.Tokarev (Dubna), [I. Zborovsky](#), J.Phys. G37 (2010) 085008

■ **The origin of the hidden supersymmetry**

[Vit Jakubsky](#), L.-M. Nieto (Valladolid U.), M.S. Plyushchay (Valladolid U. & Chile U), Phys.Lett. B692 (2010) 51-56

Research topics, publications, collaborations

FNSPE Czech Technical University

Mathematical physics close to string theory (sigma models in curved backgrounds and their symmetries, etc.), [heavy ion theory and phenomenology](#)

■ **Uncertainty Relation on World Crystal and its Applications to Micro Black Holes**

[Petr Jizba](#), Hagen Kleinert (Freie U., Berlin), Fabio Scardigli (Natl. Taiwan U.) Phys.Rev. D81 (2010) 084030

■ **A heuristic description of high-pT hadron production in heavy ion collisions**

[Jan Nemchik](#), Roman Pasechnik (Lund U.), Irina Potashnikova (Valparaiso), Eur.Phys.J. C75 (2015) 2, 95

■ **Direct Photon Production in Proton-Nucleus and Nucleus-Nucleus Collisions**

[J. Cepila](#), [J. Nemchik](#), Nucl.Phys.A862-863 (2011) 445

■ **Performance of multifractal detrended fluctuation analysis on short time series**

J. L. Lopez, [J. Guillermo Contreras](#), Phys.Rev. E87 (2013) 2, 022918

■ **Bulk Viscosity driven clusterization of QG plasma and early freeze-out in relativistic heavy-ion collisions**

G.Torrieri (Frankfurt U.), [B. Tomasik](#), I. Mishustin (Frankfurt) Phys.Rev. C77 (2008) 034903

■ **Nuclear suppression at large forward rapidities in d-Au collisions at relativistic and ultrarelativistic energies**

[J. Nemchik](#), [V. Petracek](#), I.K. Potashnikova (Valparaiso & JINR), M. Sumbera (NPI). Phys.Rev. C78 (2008) 025213

Research topics, publications, collaborations

IEAP Czech Technical University

effective hadronic interactions, top-quark spin correlations, extra dimensions, [neutrinoless double beta decay](#), [dynamical symmetry breaking & Higgsless models](#), [Higgs physics](#)

- **Chirally motivated separable potential model for ηN amplitudes,**

[A. Cieplý](#), [J. Smejkal](#), Nucl. Phys.A 919 (2013) 46–66

- **Effects of unparticle on top spin correlation at the Large Hadron Collider**

M. Arai (CQUeST, Seoul), N. Okada (KEK, Tsukuba), [K. Smolek](#), Phys.Rev. D79 (2009) 074019

- **$0\nu\beta\beta$ and $2\nu\beta\beta$ nuclear matrix elements, quasiparticle random-phase approximation, and isospin symmetry restoration**

[F. Šimkovic](#), V. Rodin, A. Faessler (Tubingen U.), P. Vogel (Caltech), Phys.Rev. C87 (2013) 4, 045501

- **Dynamics of slender monopoles and anti-monopoles in non-Abelian superconductor**

[Masato Arai](#), [Filip Blaschke](#), Minoru Eto (Yamagata U.), Norisuke Sakai (Keio U.) JHEP 1409 (2014) 172

- **Top-quark and neutrino composite Higgs bosons**

[A. Smetana](#), Eur.Phys.J. C73 (2013) 8, 2513

Research topics, publications, collaborations

Masaryk University in Brno

String theory, quantum gravity, gauge field theory, [cosmology](#), [sigma models](#)

■ **Supersymmetry Breaking and Inflation from Higher Curvature Supergravity**

I. Dalianis (Athens), [F. Farakos](#), A. Kehagias (Geneva U.), A. Riotto (Geneva U.), [R. von Unge](#), JHEP 1501 (2015) 043

■ **Branes at Quantum Criticality**

[J. Kluson](#), JHEP 0907 (2009) 079

■ **Off-shell superconformal nonlinear sigma-models in three dimensions**

S.M. Kuzenko (Western Australia U.), J.-H. Park (Sogang U.), G. Tartaglino-Mazzucchelli (Uppsala U.), [Rikard von Unge](#)
Published in JHEP 1101 (2011) 146

■ **New extended superconformal sigma models and Quaternion Kahler manifolds**

S.M. Kuzenko (Western Australia U.), Ulf Lindstrom (Uppsala U.), [Rikard von Unge](#), JHEP 0909 (2009) 119

■ **Naturalness and Chaotic Inflation in Supergravity from Massive Vector Multiplets**

[Fotis Farakos](#), [Rikard von Unge](#), JHEP 1408 (2014) 168

■ **Gauge Independence in a Higher-Order Lagrangian Formalism via Change of Variables in the Path Integral**

I.A. Batalin (Lebedev Inst.), [Klaus Bering](#), Phys.Lett. B742 (2015) 23-28

Research topics, publications, collaborations

Silesian University in Opava

Phenomenology of hadrons, [sigma models](#), [supersymmetry](#), [extra dimensions](#)

- **The vector resonance triplet with the direct coupling to the third quark generation**
[Mikulas Gintner](#), [Josef Juran](#), Published in Eur.Phys.J. C73 (2013) 10, 2577
- **Vector meson dominance and the π^0 transition form factor**
[Peter Lichard](#), Phys.Rev. D83 (2011) 037503
- **Joint description of the $e^+ e^-$ annihilation into both four-pion channels**
[Josef Juran](#), [Peter Lichard](#), Phys.Rev. D78 (2008) 017501
- **Cotangent bundle over Hermitian symmetric space $E7/E6 \times U(1)$ from projective superspace**
Masato Arai (IEAP CTU, Prague & Fukushima NCT.), [Filip Blaschke](#), JHEP 1302 (2013) 045
- **Matter Fields and Non-Abelian Gauge Fields Localized on Walls**
Masato Arai (Fukushima NCT & CTU), [Filip Blaschke](#), Minoru Eto (Yamagata U.), Norisuke Sakai (Tokyo Woman's Christian U.), PTEP 2013 (2013) 013B05

A bit of scientometry

INSPIRE query: “institutions” and (primarch hep-ph or primarch hep-th) and date after mar 2007

Citation summary results	Published only excluding self cites
Total number of papers analyzed:	<u>246</u>
Total number of citations:	2,892
Average citations per paper:	11.8
Breakdown of papers by citations:	
Renowned papers (500+)	<u>0</u>
Famous papers (250-499)	<u>1</u>
Very well-known papers (100-249)	<u>2</u>
Well-known papers (50-99)	<u>8</u>
Known papers (10-49)	<u>66</u>
Less known papers (1-9)	<u>133</u>
Unknown papers (0)	<u>36</u>

A bit of scientometry

INSPIRE query: “institutions” and (primarch hep-ph or primarch hep-th) / all times

Citation summary results	Published only excluding self cites
Total number of papers analyzed:	<u>437</u>
Total number of citations:	6,647
Average citations per paper:	15.2
Breakdown of papers by citations:	
Renowned papers (500+)	<u>1</u>
Famous papers (250-499)	<u>1</u>
Very well-known papers (100-249)	<u>6</u>
Well-known papers (50-99)	<u>18</u>
Known papers (10-49)	<u>128</u>
Less known papers (1-9)	<u>225</u>
Unknown papers (0)	<u>58</u>

So the last period contributed by: more than 50 % of the total # of CR HEP INSPIRE records
more than 40 % of the total cites

International schools & courses

- **Indian summer schools (NPI ASCR):**
 - 2012: Neutrino physics
 - 2013: Hot & dense QCD
 - 2014: Low-energy hadrons
- **Central European School in Particle Physics (IPNP)**
 - 2007: PDFs, EWSB, chiral SB, neutrinos, SM, SUSY pheno
- **Biannual intensive graduate-level courses**
 - 2007: Renormalization (C. Becchi)
 - 2009: SUSY theory and phenomenology (A. Masiero)
 - 2011: GUT phenomenology (MM)
 - 2013: Cosmology (A. Riotto)

International schools & courses

- **Indian summer schools (NPI ASCR):**

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*Central
European
Joint
Programme
for doctoral studies
in theoretical physics*

Extension of the former
“Triangle” collaboration
including Prague, Bratislava,
Budapest, Ljubljana, Padova,
Trieste, Vienna Zagreb Uni’s
+SISSA

Theory funding

- **Regular (bulk) funding** for more info see the slides of J. Chýla
 - Institutional funding
 - Grant agency of the Czech republic (GACR)
 - Centre for particle physics (finished in 2011)
- **“Occasional” external individual funding:**
 - EURYI (2008-2013) - string theory
 - ERC - a cosmology fellow since August (4 years)
 - ASCR J. E. Purkyně fellowship (up to 5 years) - a fellow since September
 - FP7 Marie Curie actions (CIG 2012-2016) - BSM theory
 - “Neuron” (private donor) - BSM postdoc hired for 2014-2016
- **Travel and equipment** good, on average some 4-5 kEuro / year / person

Theory postdoc funding

- CR is getting quite popular for foreign postdocs now (even short-term)!
- The available public funding is often **irregular / insufficient / rigid**
- Still missing a **regular, competitive & open** short-term (T)P funding scheme
- Some kind of distinguished fellowships (like, e.g., Humboldt) would be just great
- Partly a structural / bureaucratic issue

Symptoms of the transition period ...

Summary and outlook

- The community has grown quite a bit
- The fraction of foreigners/people with extended f. experience grew substantially
- We are becoming attractive for foreign (w) postdocs, even short-term
- The publication/citation rates have improved considerably
- New topics, more activity now related directly to CERN experiments
- There are PT topics that would desire more coverage (e.g., astroparticles)
- The funding is livable, structural changes would be welcome + postdoc support

Summary and outlook

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Let's (not only) see what the future brings!

Thank you for your kind attention!