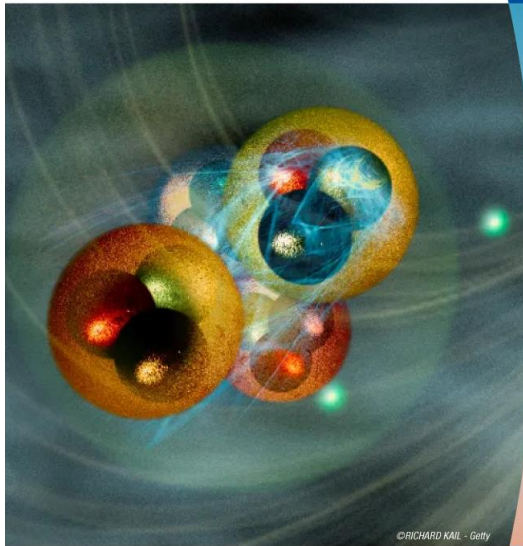


Welcome!



CONVENTION
20-23 JUNE 2022
PARIS

*Sorbonne
Université
Campus Pierre
et Marie Curie
place Jussieu*



<https://indico.mitp.uni-mainz.de/event/308/>



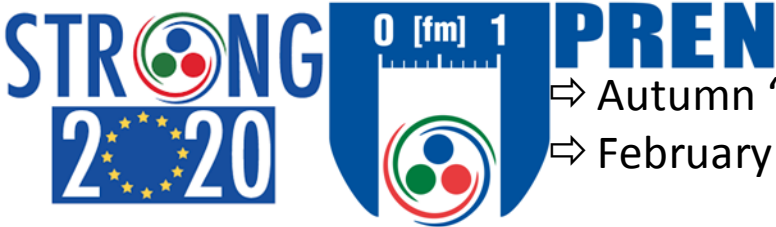
Organizing committee:

J.-P. Karr
D. Marchand
R. Pohl
E. Voutier

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 824093

Organizing committee: Jean-Philippe Karr, Dominique Marchand, Randolph Pohl, Eric Voutier

<https://indico.mitp.uni-mainz.de/e/pren2022>



- ⇒ Autumn '17: PREN proposal to STRONG-2020 (DM, Randolph Pohl)
- ⇒ February '18: selected to be part of the STRONG-2020 proposal as Workpackage 15 – Network Activity (NA) #4
- ⇒ June '19: official starting date of the STRONG-2020 project (4 yrs)

Proton charge Radius European Network

Experimental determination of the proton charge radius:

- Lepton scattering off protons, nuclear physics
- Atomic spectroscopy, atomic physics
 - ↗ Hydrogen atoms, hydrogen molecular ions
 - ↘ Muonic hydrogen, muonic ions

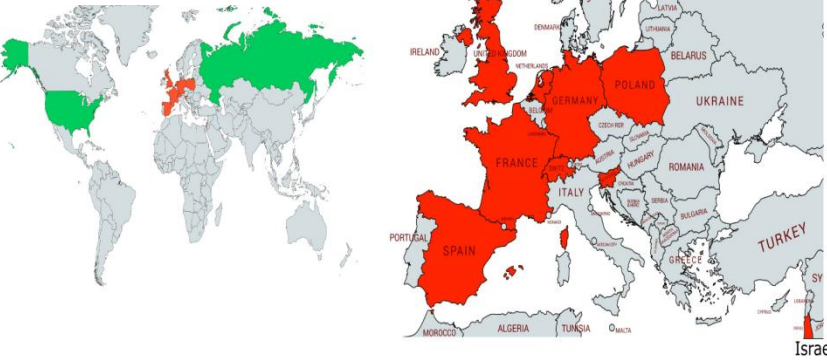
Motivation:

To **stimulate** and support a real **synergy** between all the physicists involved in the world-wide **experimental** and **theoretical** effort from **atomic spectroscopy** and **lepton scattering** in order to **fully understand** the persistent discrepancies and to come to a statement on the **value of the proton charge radius**.

By means of topical workshops and narrower collaborations

PREN: 22 institutions / 11 countries

Eligible EU countries
Other countries



- CEA Saclay/DRF/Irfu/Département de Physique Nucléaire, France; N. D'Hose,
- CNRS: France; D. Marchand (IPN Orsay) and J.-Ph. Karr (LKB, Paris), G. Quémener (LPC Caen), H. Fonvielle (LPC Clermont-Ferrand),
- ETH Zurich, Switzerland; P. Crivelli,
- Hebrew University, Jerusalem, Israel; G. Ron,
- JG University Mainz, Germany; M. Ostrick, R. Pohl, M. Vanderhaeghen,
- JWG University Frankfurt, Germany; R. Grisenti,
- Jožef Stefan Institute, Ljubljana, Slovenia; M. Mihovilović, S. Sirca,
- LaserLaB, Vrije Universiteit, Amsterdam, Netherlands; W. Vassen, K. Eikema,
- MPQ Garching, Germany; T.W. Hänsch, Th. Udem, S. Karshenboim,
- Paul-Scherrer-Institut (PSI), Villigen, Switzerland; A. Antognini,
- Technische University München, Garching, Germany; S. Paul,
- Universitat Autònoma de Barcelona / IFAE, Spain; A. Pineda,
- University College of London, London, UK; D. Cassidy,
- University of Warsaw, Warszawa, Polska; Krzysztof Pachucki.

Theorists and
Experimentalists
from
Atomic and Lepton
Scattering Physics

- Bogoliubov Laboratory of Theoretical Physics, JINR Dubna, Russia; V. Korobov,
- George Washington University, Washington DC, USA; A. Afanasev,
- CFNS, Stony Brook University & RIKEN BNL Research Center ; J. Bernauer,
- North Carolina A&T State University, Greensboro, NC, USA; A. Gasparian,
- Rutgers, The State University of New Jersey, Piscataway, NJ, USA; R. Gilman,
- Petersburg Nuclear Physics Institute (PNPI), Gatchina, Russia; A. Vorobyov

Annual meetings:

- 23-25/10/2019 (Kick-off), Nantes
- 14-16/10/2020 [virtual]
- 08-10/11/2021 [hybrid], Nantes
- 17-19/10/2022, Paris

Conclusions

Summary

- New R_p result from 1S-3S transition frequency measurement (MPQ, Garching)
- Updated precision calculations of fundamental constants (LKB and collaborators)
- Constraints/limits on BSM physics invoked to address the proton radius puzzle
- Many re-analyses of available lepton scattering data including TMVA techniques
- Recent exhaustive reviews published

Small value of proton charge radius is favored
 ----> the proton radius puzzle seems to be resolved (less tension)

Discrepancies

- between lepton scattering R_p large value and PRad and hydrogen (ordinary/muonic) spectroscopy
- between values from ordinary hydrogen spectroscopy (LKB Paris – Toronto – MPQ Garching)
- between values from ordinary hydrogen (LKB Paris) and muonic hydrogen like atoms/molecules

have to be fully understood

Waiting for results from:

- « New » Mainz A1 (gas jet target) e-p scattering
- MUSE ($e^{+/-} / \mu^{+/-} - p$ scattering)
- H_2^+ , μ^3He

Conclusions

Perspectives

Perspectives in lepton-p scattering:

- PRES@A2 (MaMi, Mainz), 2022-
- PRM, COMPASS++/AMBER-CERN, 2022-
- ULQ2 (Japan), 2022-
- MAGIX@MESA, Mainz, 2024-
- PRad II (JLab), 2024-

Perspectives in atomic physics:

- μD
- hydrogen molecular ions
- muonium

Theoretical/ analytical developments

Our network activity suffered dramatically from the pandemic situation delaying experiments and preventing us to meet in person.

➤ **PREN meeting in person in Paris in Spring 2022**

➤ **Investigating the opportunity for « new » collaborative activities**

➤ **Precision Measurements and Fundamental Physics:**

The Proton Radius Puzzle and Beyond

July 23-27, 2018 – Mainz (Germany)

(~30 participants: atomic and nuclear physicists)



JOHANNES GUTENBERG
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Mainz Institute
for
Theoretical Physics



PREN
Proton
Radius
European
Network

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- ⇒ « Nuclear charge radii and polarizabilities from laser spectroscopy of light muonic atoms » by **Randolf Pohl**
- ⇒ « The proton radius from electron scattering measurements (and other thoughts about form factors) » by **Jan C. Bernauer**

End of the morning session at 12:20 (sharp) – Lunch is served at **12:30 everyday**

After lunch: hydrogen spectroscopy and lepton scattering

After the break: Transverse conference « On the meaning of measurement uncertainty »

6:30 pm - ~8pm: Welcome reception at « Le Buisson Ardent » (Bar à vins), 25 rue Jussieu



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PREN2022 organizing committee

Wishes for a fruitful and enjoyable meeting