Laser Photodetchment Threshold Spectroscopy on Radioactive Negative Ions

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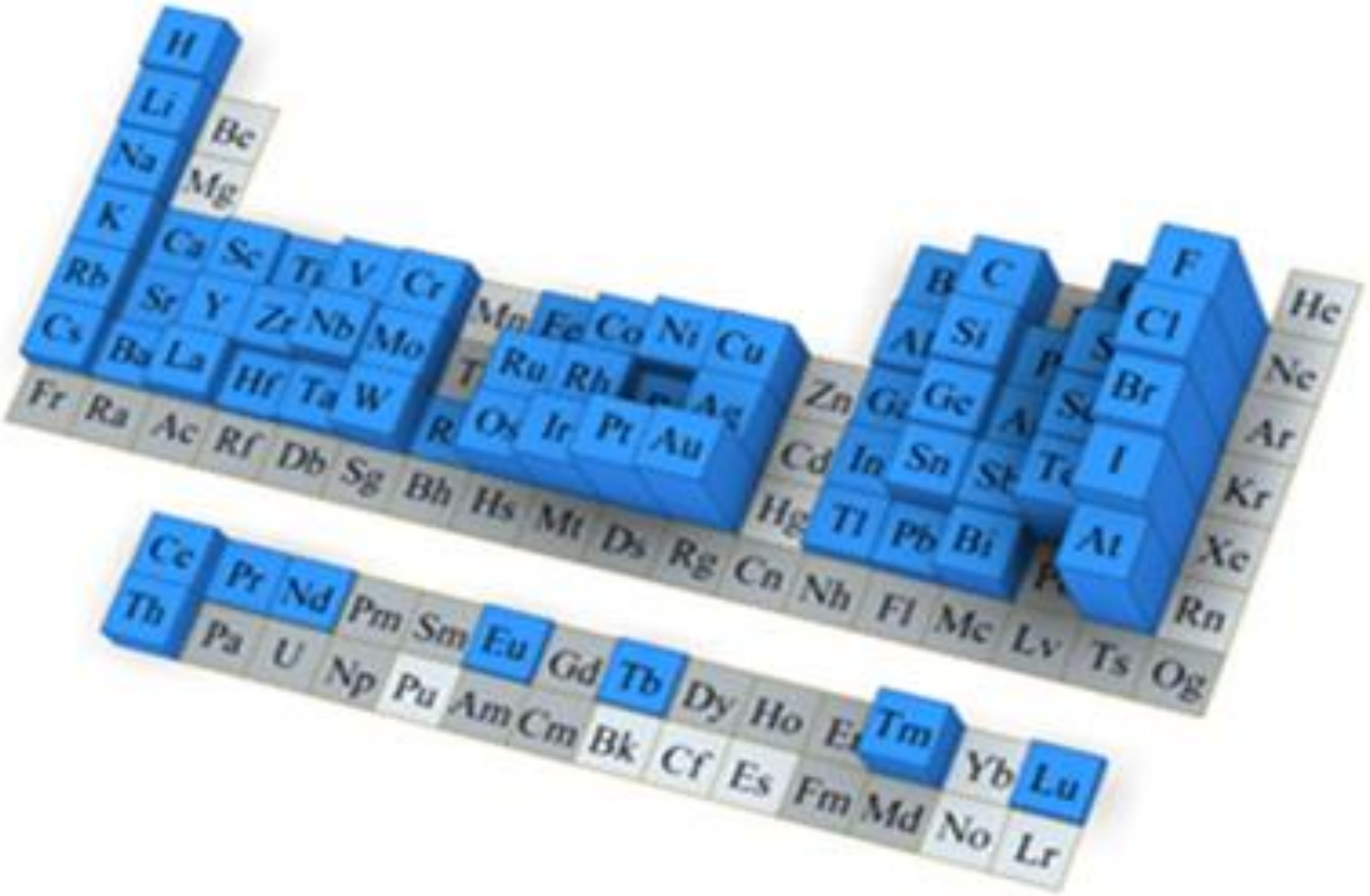
“Development of Quantu Optics and Photonics at University of Latvia”

ISOLDE we are doing spectroscopy of ions for nuclear physics research

- We are rookies, started only last year in this CERN Baltic league.
- Year2022 signed user's contract between CERN and ASI for 3 years with ~10% duty cycle and me as team leader
- Worked in CERN on development of MIRACLS and demonstration experiment, trapped Cl anions in June 2022.
- Reported results in 28th International Nuclear Physics Conference and few more, and manuscript for publication is in preparation
- Got idea for application for grant application at Latvian Council of Science for project based on experiments performed in CERN, Riga, Sweden.
- Finally, we received support for next 3 years, starting from year 2024

Negative ions, across the periodic table,

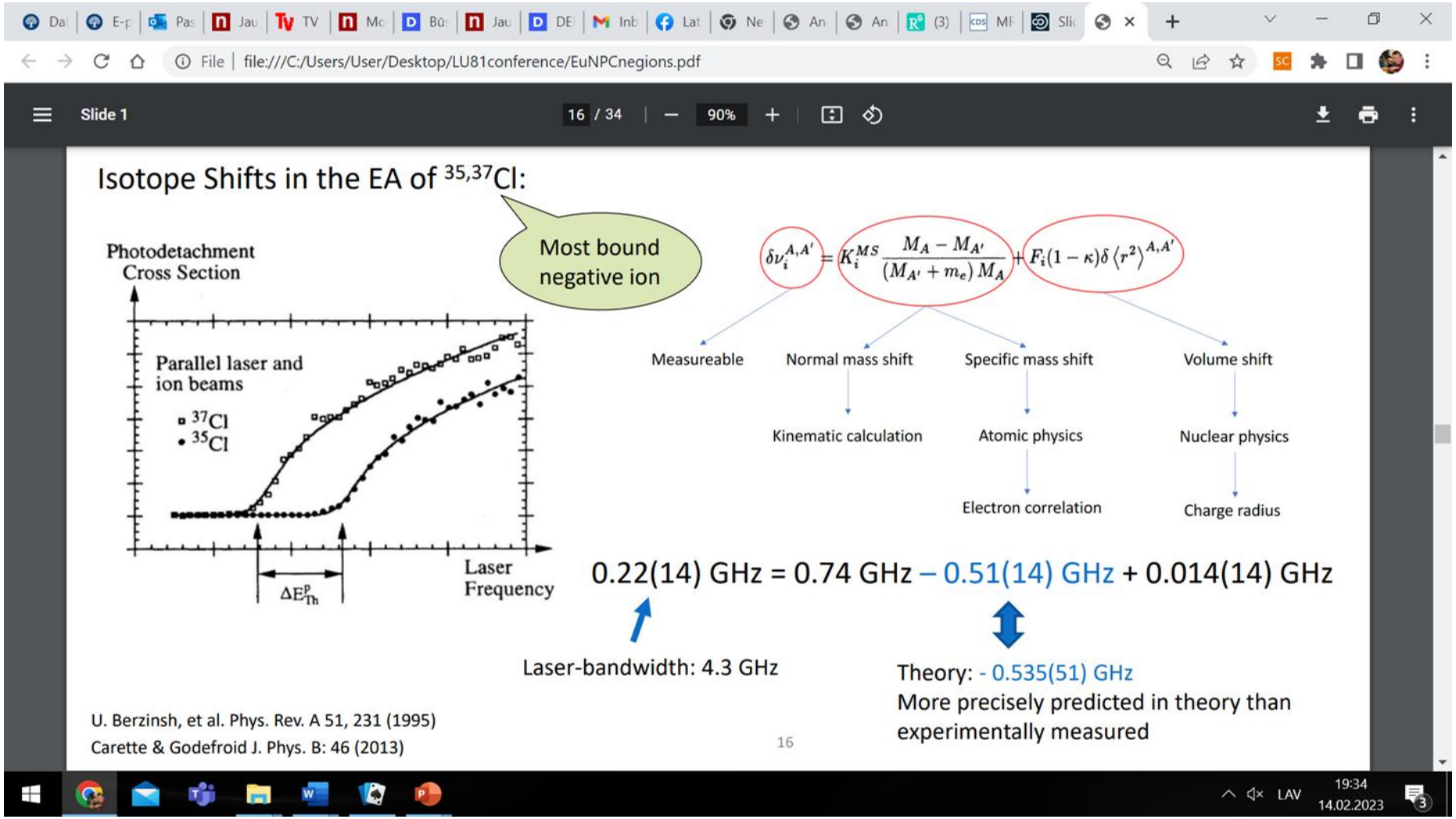


Blue- height indicates the measured EA.
Light gray- predicted to not exist,
Dark grey- does not have a clear prediction and here is room for experimental search

Suitable Chlorine isotopes for experiment and for comparison with theory.

- Mass34 31.99(3) min
- Mass35 stable
- Mass36 301300 y
- Mass37 stable
- Mass38 37.24(5) min
- Mass39 56.2(6) min
- Mass40 1.35(2) min

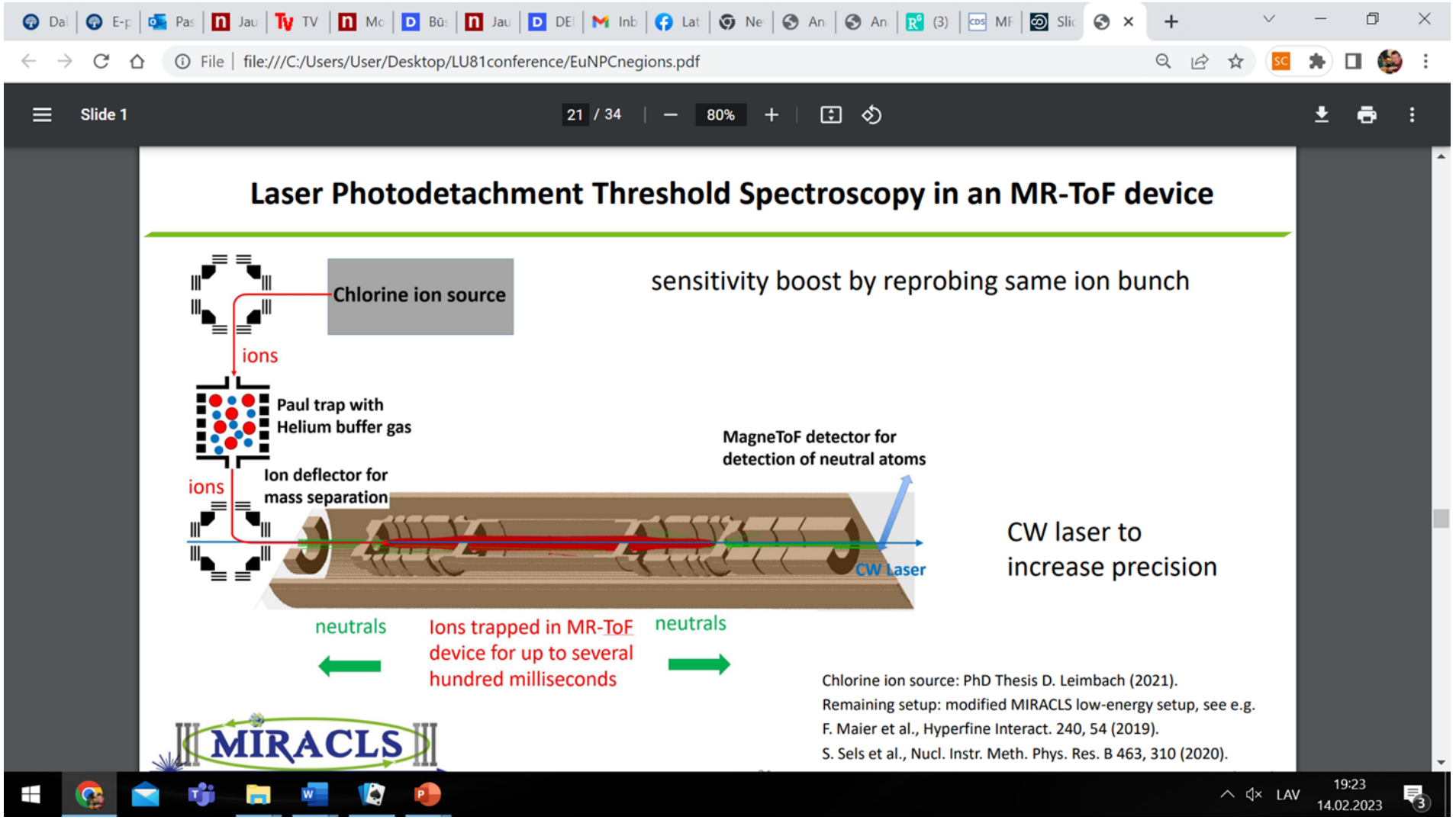
Isotope shift result for Clorine anion.



Properties of atomic negative ions

- Binding of an extra electron to a neutral atom in a short-range potential is proportional to ~r^{-4} (for atoms and positive ions it is proportional to r^{-1}).
- Can usually only bind the fine or hyperfine structure states of the ground state term or in case of several terms of the energetic lowest lying ones
- Only for few negative ions few optical transitions are allowed.
- Therefore in most cases photodetachment threshold is measured.

MIRACLS- **M**ulti **I**on **R**eflection **A**pparatus for **C**ollinear **L**aser **S**pectroscopy



Thank you for attention!

And many thanks to my colleagues and key inspirers:

-Prof. Dag Hanstorp, University of Gothenburg, leader of negative ion activities at CERN

-Prof. Stephan Malbrunot CERN, ISOLDE, MIRACLS, project leader

-Dr. Erich Leistenschneider, CERN, ISOLDE, MIRACLS, principal investigator

-Prof. Rashid Ganeev, University of Latvia, ERA Chair holder

-Ass. prof. Jānis Alnis, University of Latvia , Deputy team leader in contract