N01: Neutron skin and surface thickness of ^{208}Pb

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Institute for Nuclear Physics, Johannes Gutenberg-University Mainz

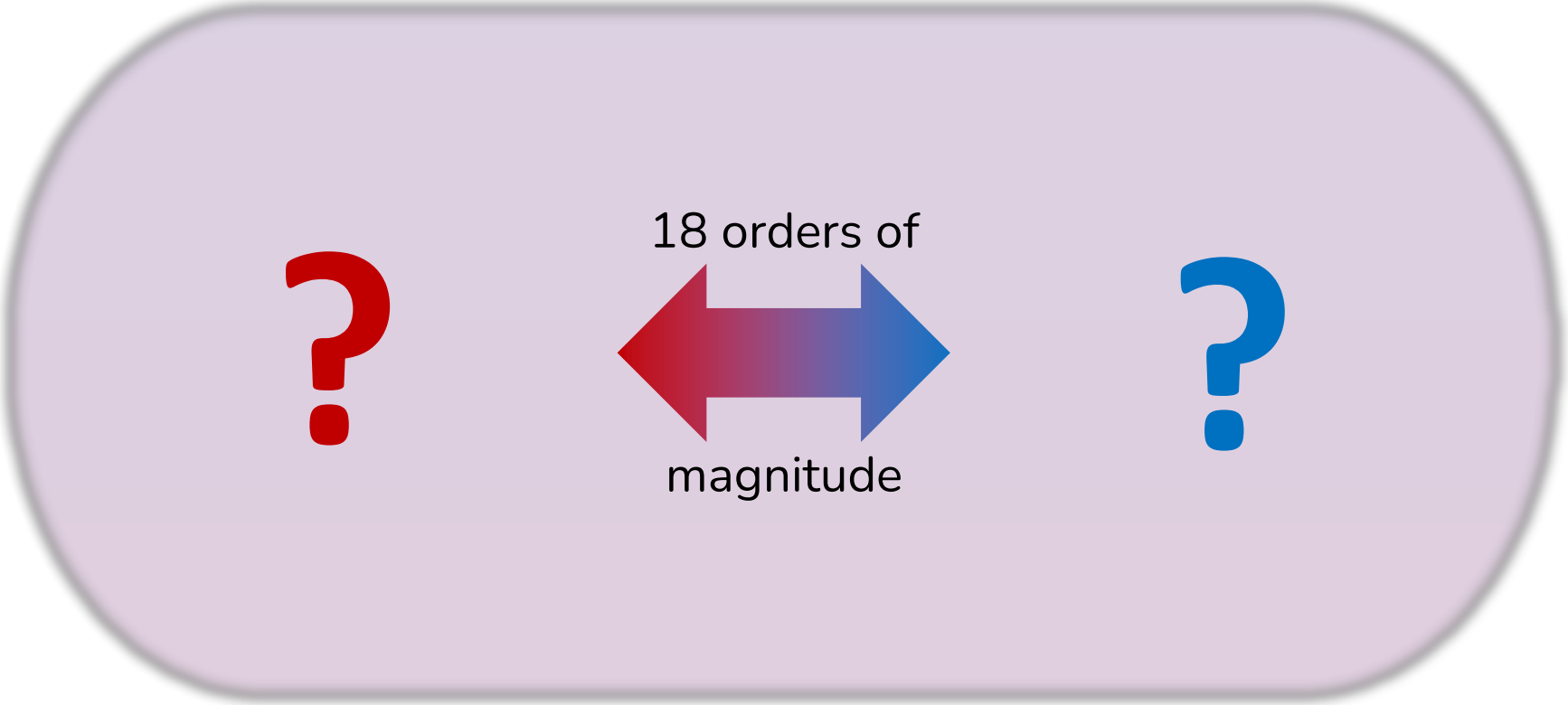
CRC 1660 Kick-Off

Cluster of Excellence PRISMA+ Precision Physics, Fundamental Interactions and Structure of Matter

Hadrons Nuclei CRC 1660

JOHANNES GUTENBERG UNIVERSITÄT MAINZ

Connecting different scales



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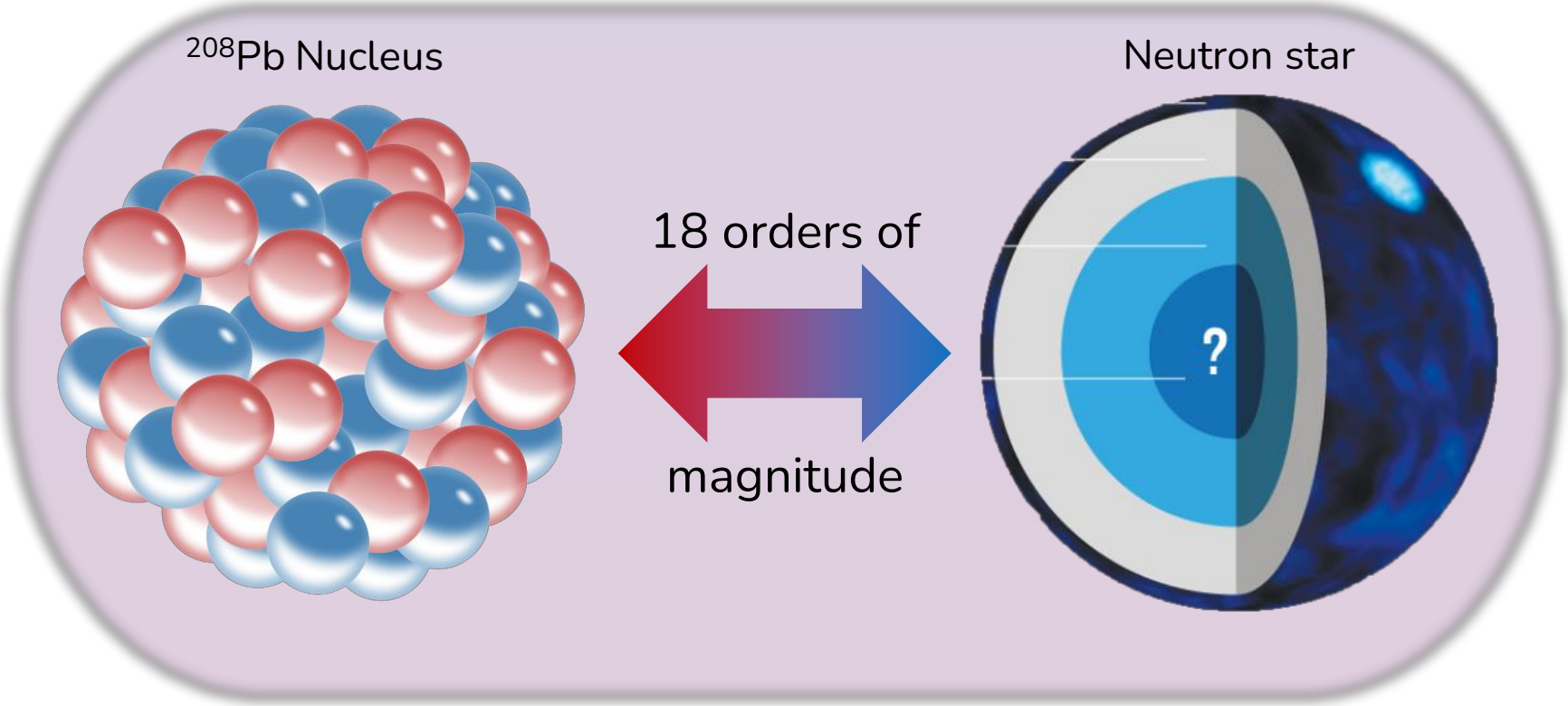


Neutron Skin and PREX-II

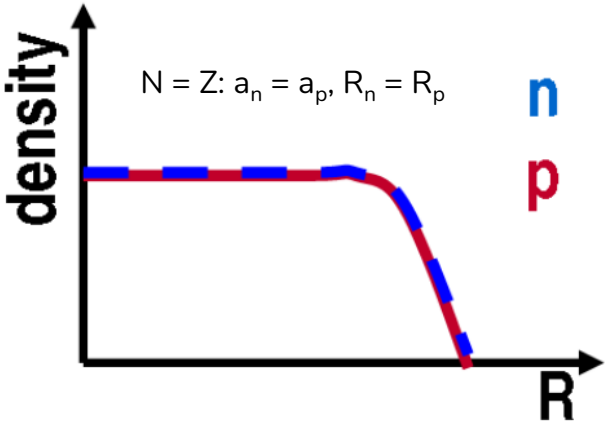
Nucleus

$$R_{skin} = R_n - R_p$$
$$R_n = \sqrt{\langle r_n^2 \rangle}$$
$$R_p = \sqrt{\langle r_p^2 \rangle}$$

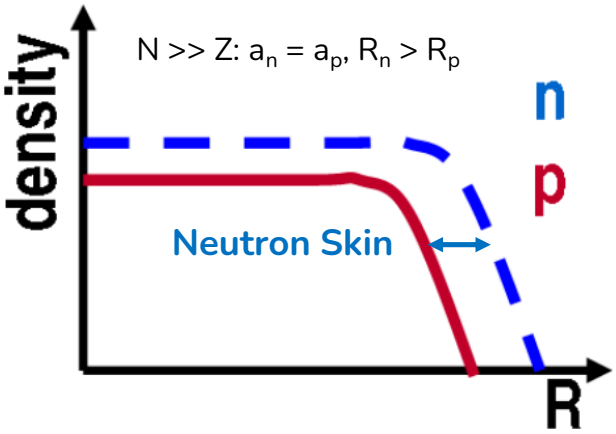
Neutron star

$\Lambda_\star$(LIGO)
$R_\star$(NICER)

$$\mathcal{E}(\rho,\alpha) = \mathcal{E}_{\rm SNM}(\rho) + \alpha^2 \mathcal{S}(\rho) + \mathcal{O}(\alpha^4)$$
$$\alpha \equiv (\rho_n - \rho_p)/(\rho_n + \rho_p)$$
$$L \equiv 3\rho_0 \left(\frac{\partial S}{\partial \rho}\right)\Big|_{\rho_0}$$



J. Phys. G, **46** (2019), 093003



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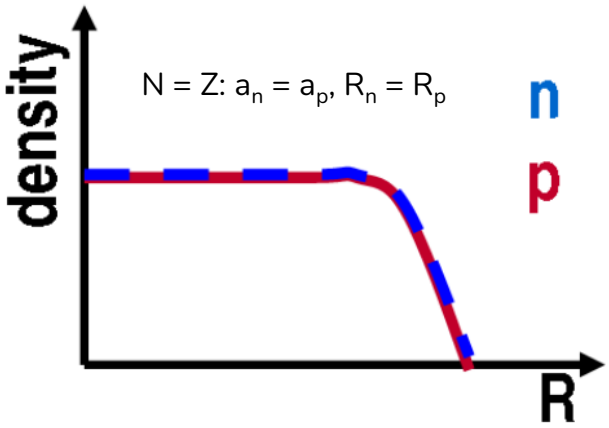

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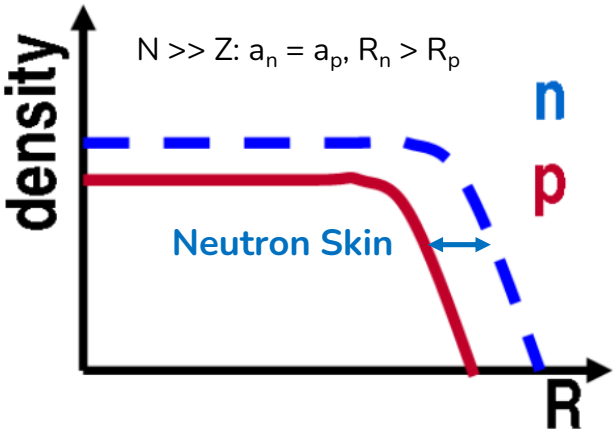

PREX-II: PVES determination of R_{skin} in ^{208}Pb
But: low statistics and tension with **astrophysics**

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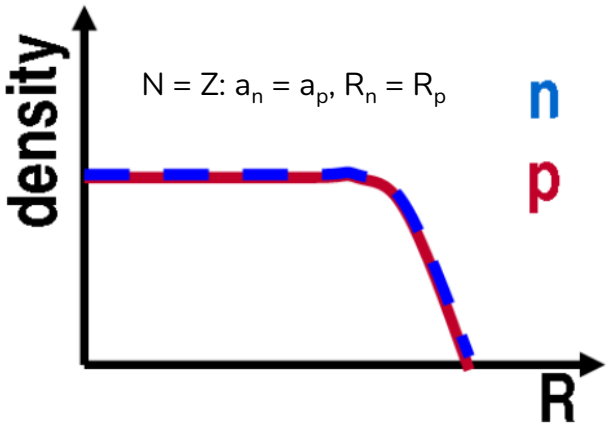

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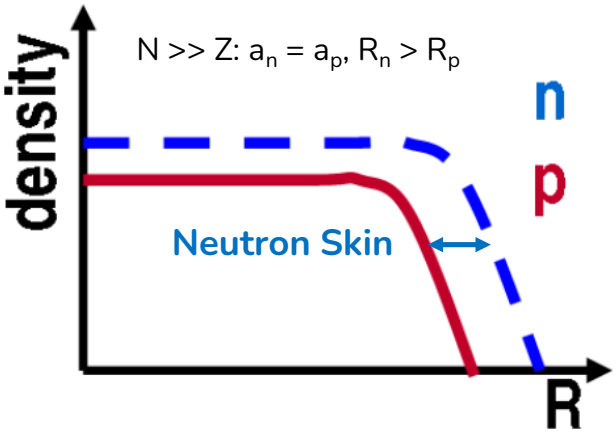

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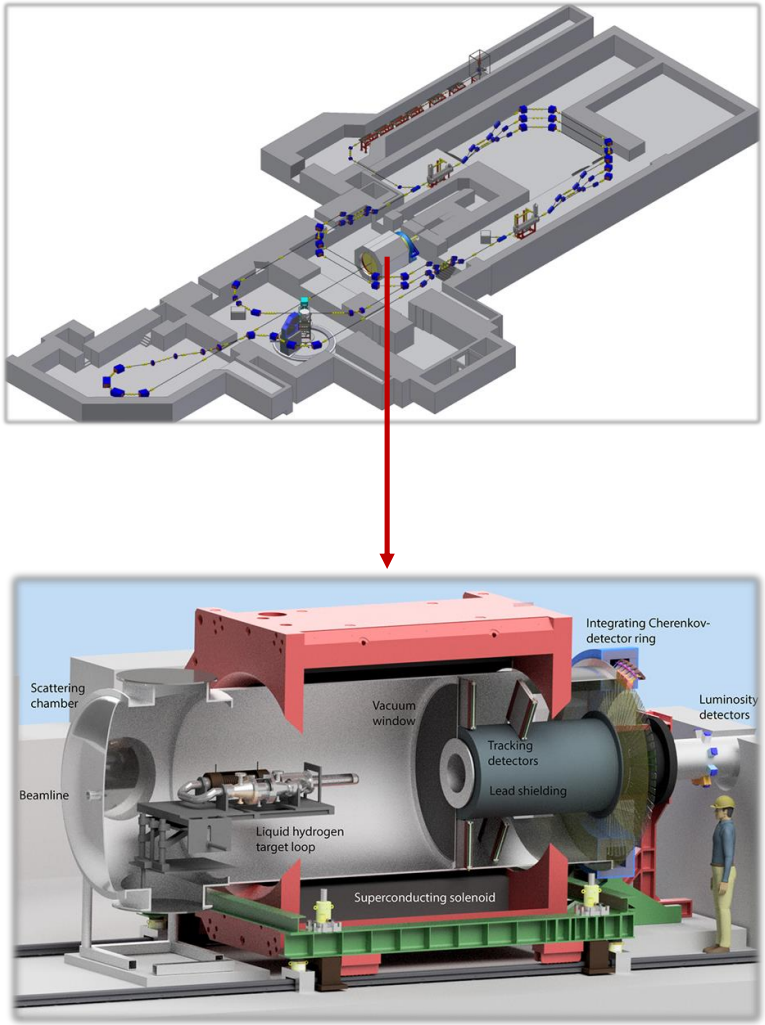
MREX

Outline

- Want to use Mainz Energy-recovering Superconducting Accelerator (**MESA**) and the **P2** experiment detector setup



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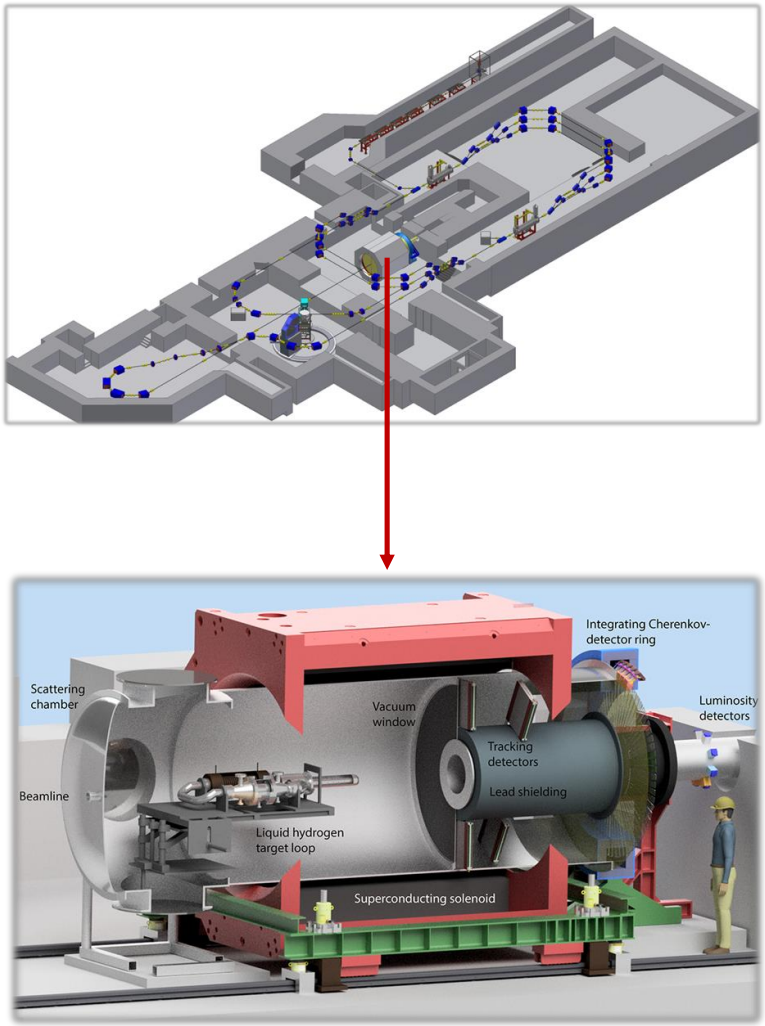
- Want to use Mainz Energy-recovering Superconducting Accelerator (**MESA**) and the **P2** experiment detector setup

- Need to match **<Q^2>** = 0.0062 $(GeV/c)^2$ of PREX-II

$$Q^2 = -q^2 = -(p - p')^2 = \frac{4EE'}{c^2} \cdot \sin^2\left(\frac{\theta}{2}\right)$$



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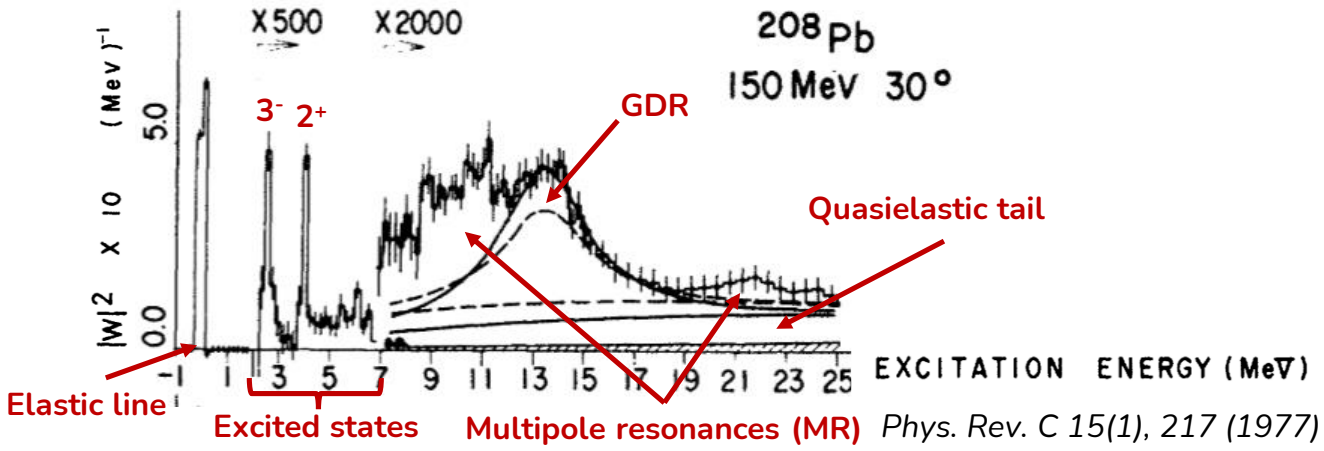
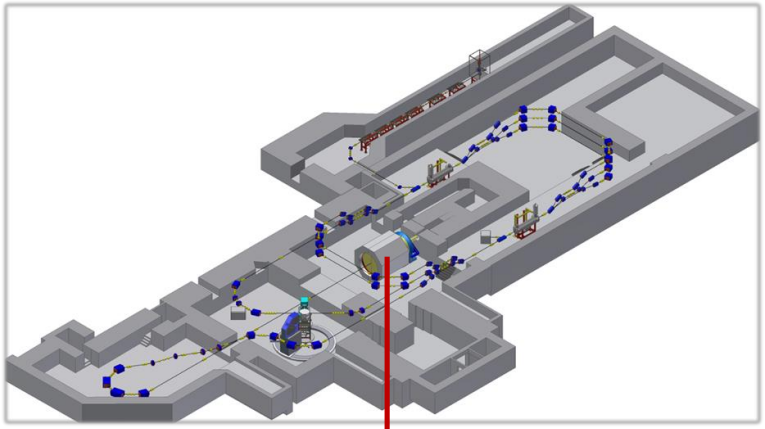
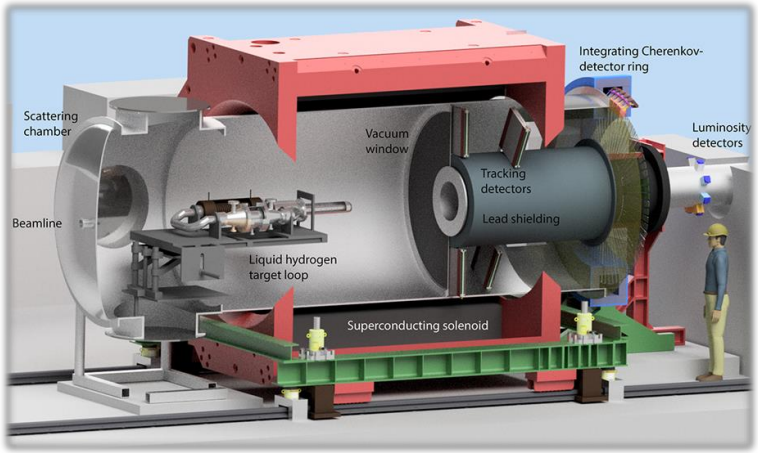
- Must account for and minimize **non-elastic contributions**



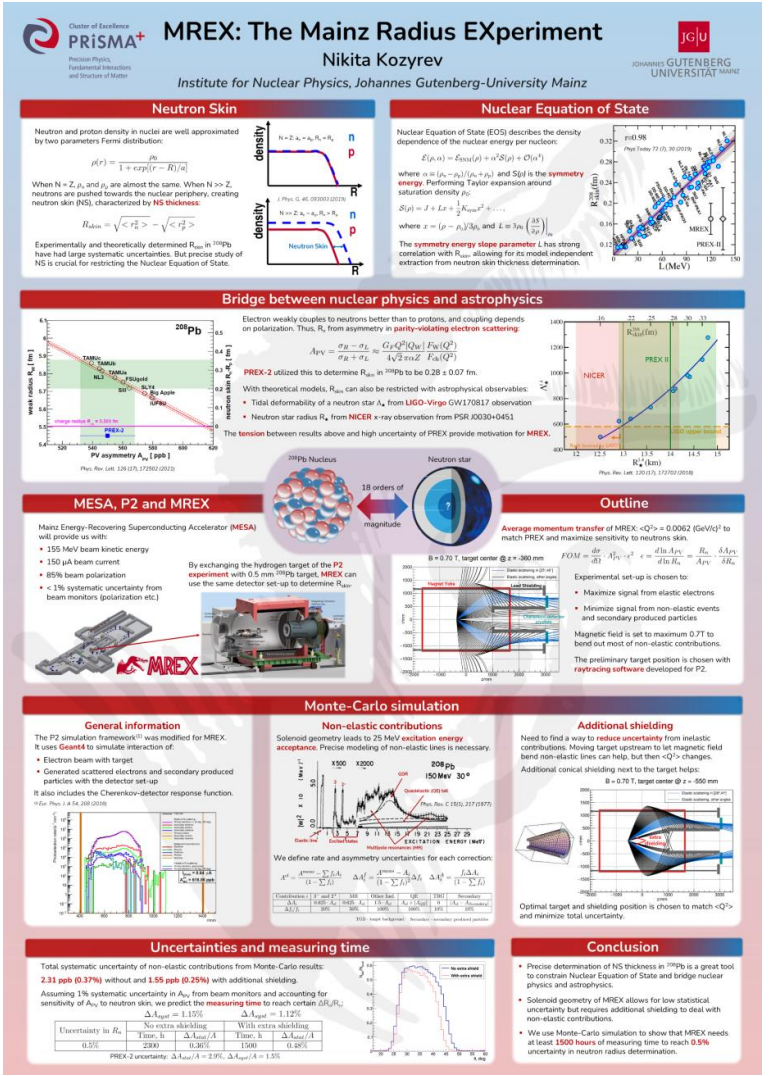
Phys. Rev. C 15(1), 217 (1977)





Come by to learn:

- How the simulation framework is built
- How to reduce uncertainty from non-elastics
- Which uncertainty in R_n can we reach
- How much measuring time we need



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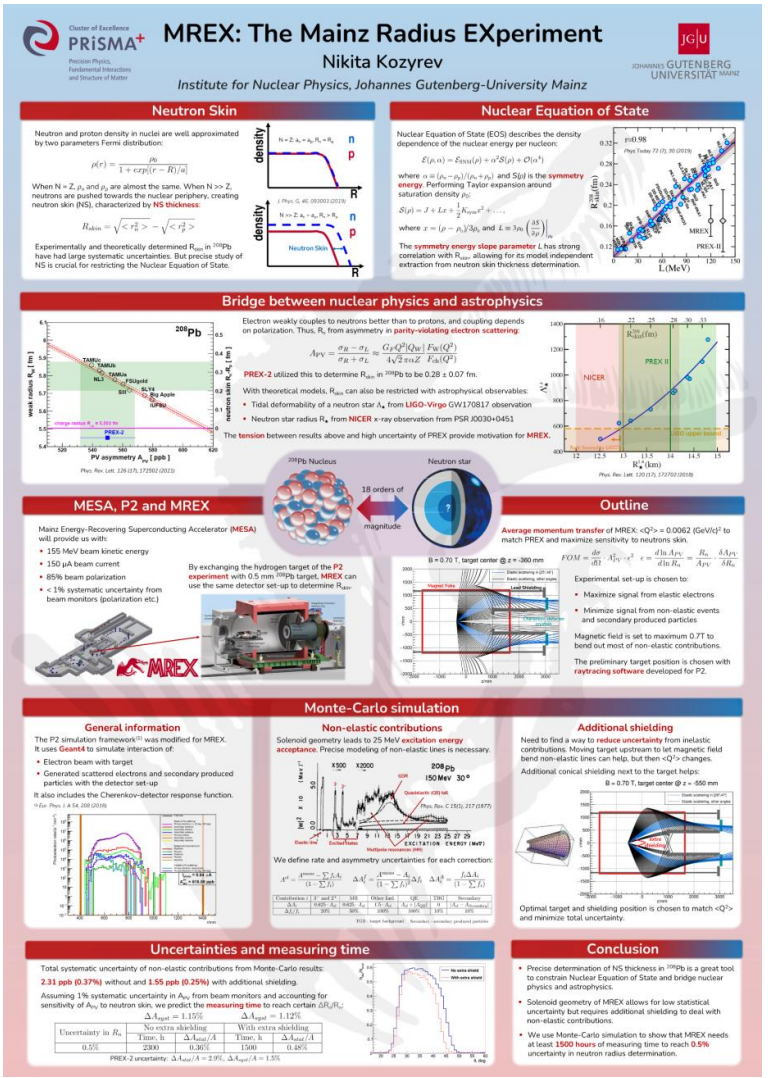
Thank you for your attention!