Presentation : who am I & what am I working on ?

Chloë Hebborn

March, 25 2024

From Brussels, to Mainz, to the USA, to IJClab ☺...

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Master & PhD Thesis
(2015-2020)

Improving eikonal reaction model

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FACILITY FOR RARE ISOTOPE BEAMS

Lawrence Livermore National Laboratory

FRIB Theory Fellowship (2020-2023)
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Ab initio prediction for astrophysical reactions

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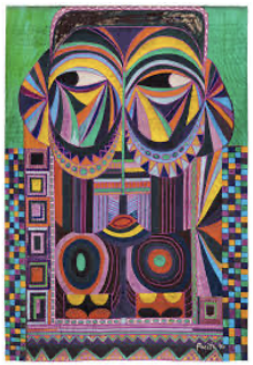
Since February 2025, CRCN at IJClab ☺

Hobbies

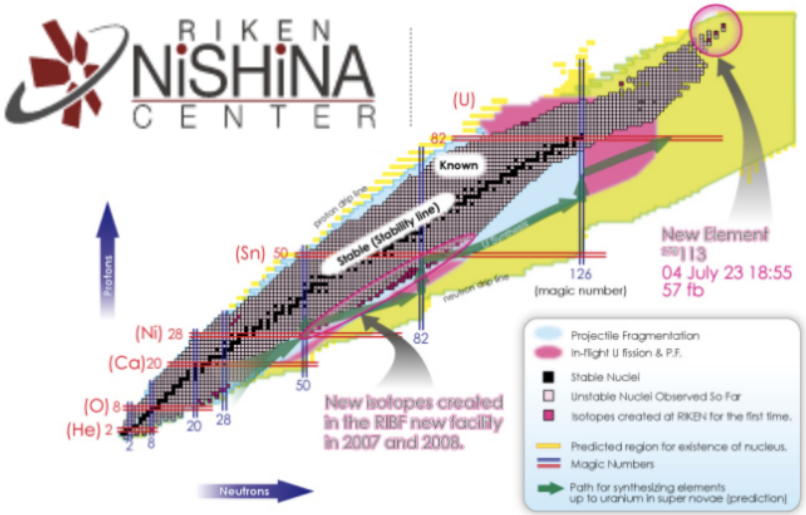
Hiking, Travelling, being outdoors!

Music, concerts

Art exhibition
(credit Pacita Abbad)



RIB facilities around the world are pushing the boundaries and rely heavily on nuclear reactions !



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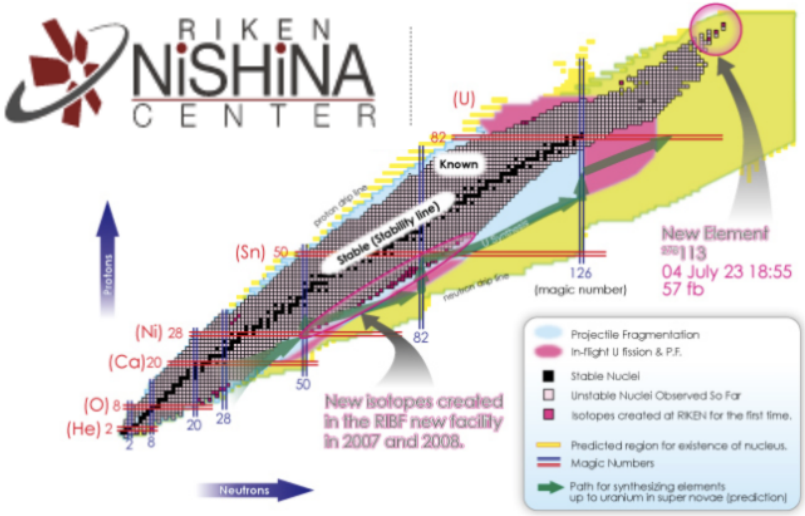

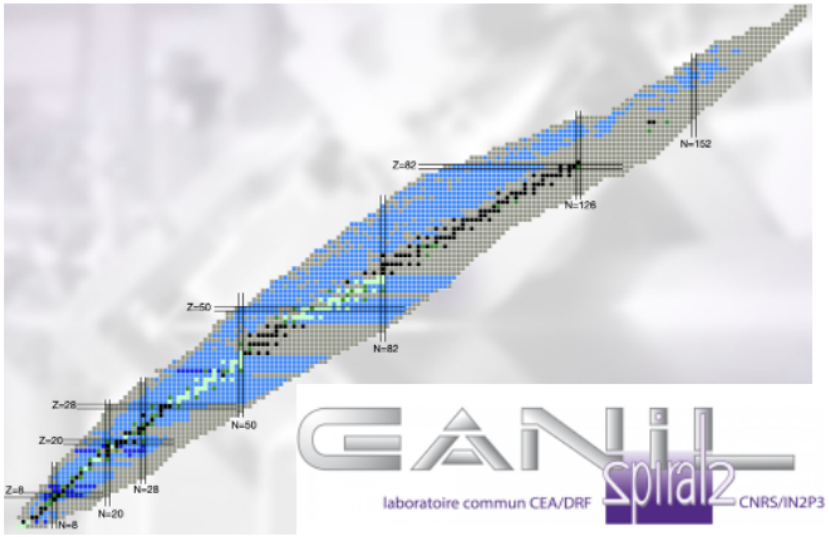

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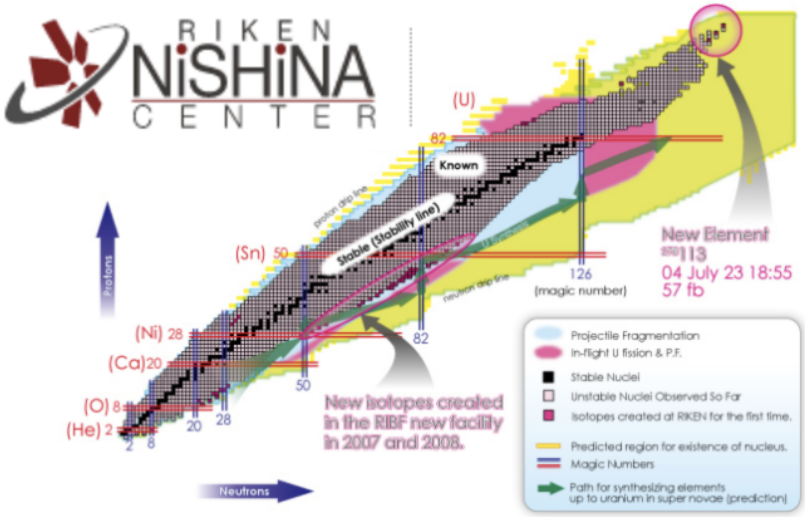

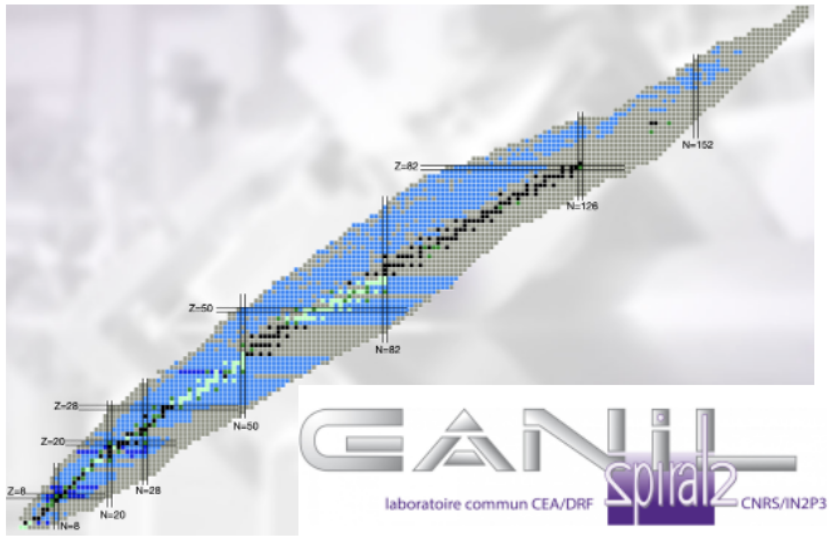

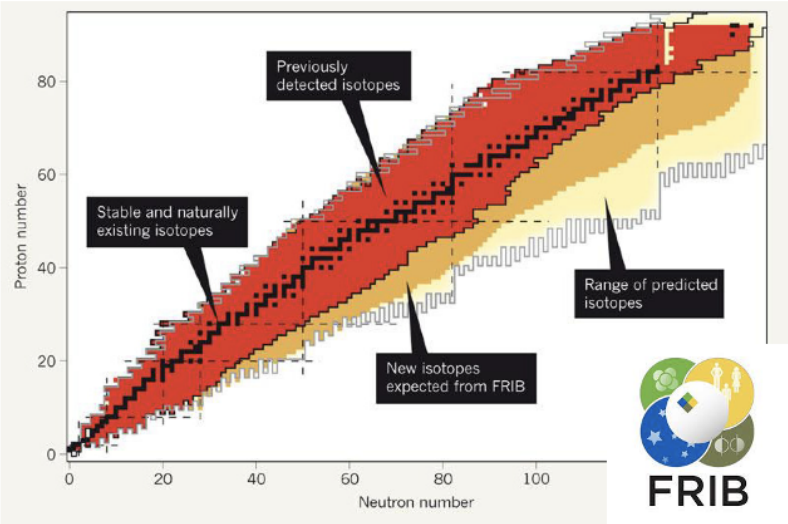

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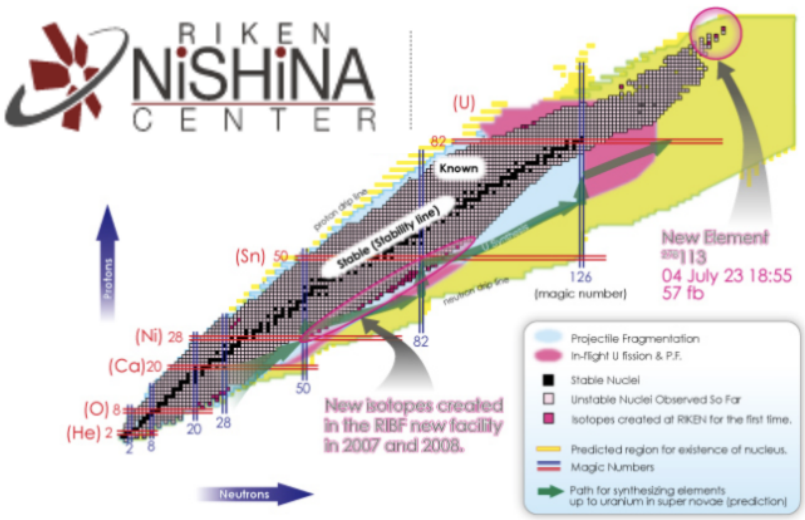
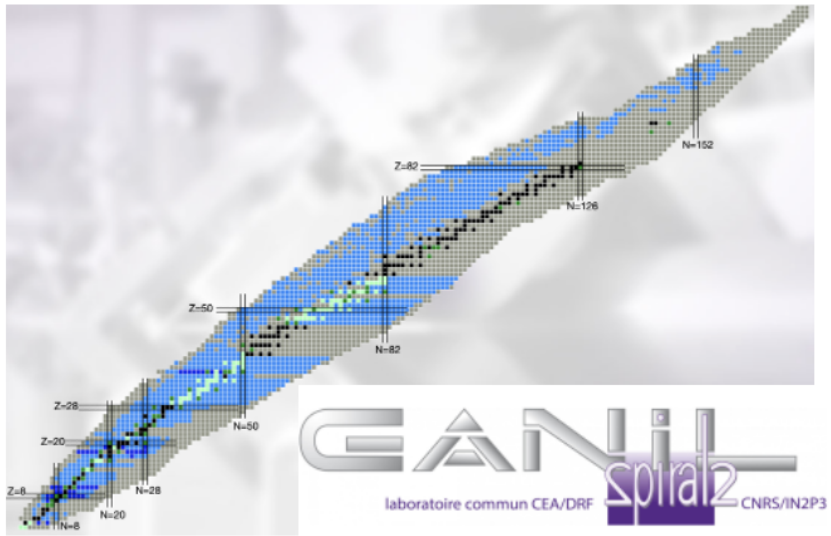
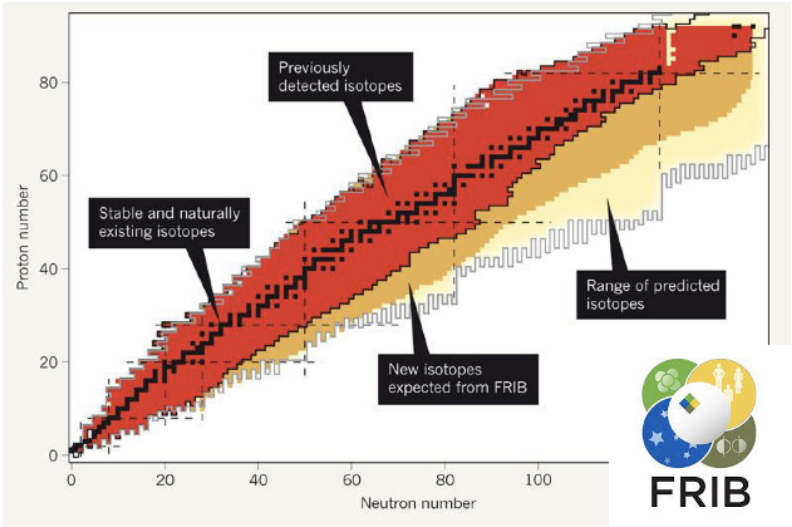
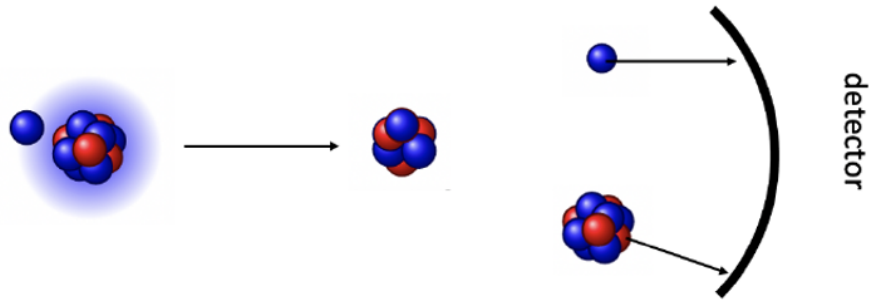


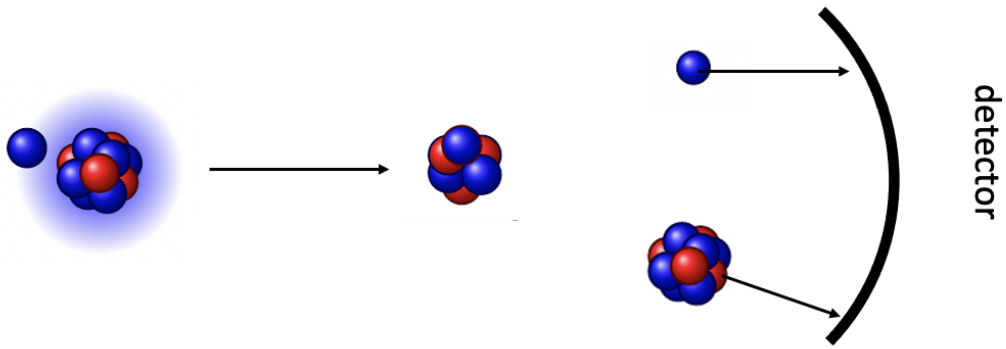


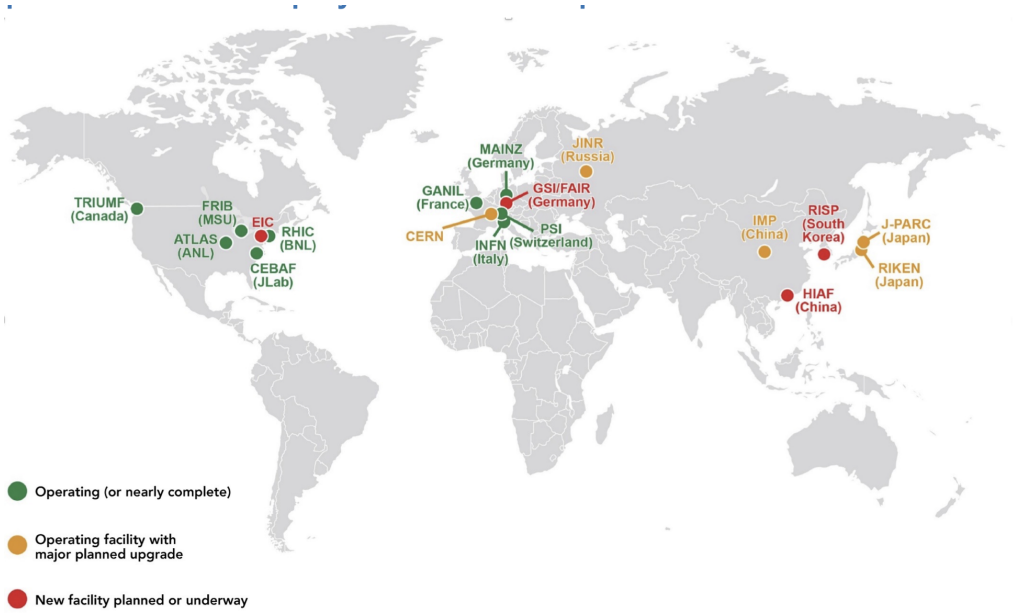


Unstable nuclei are synthetized and often studied through **nuclear reactions**



Accurate predictions are needed to support the analysis of experiments and for reactions not accessible experimentally





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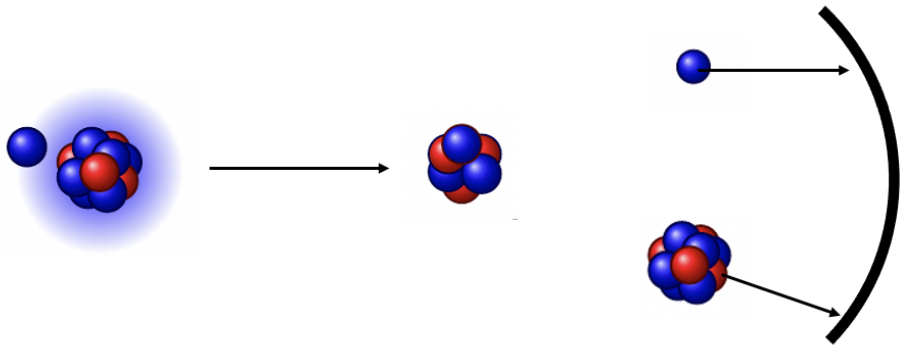
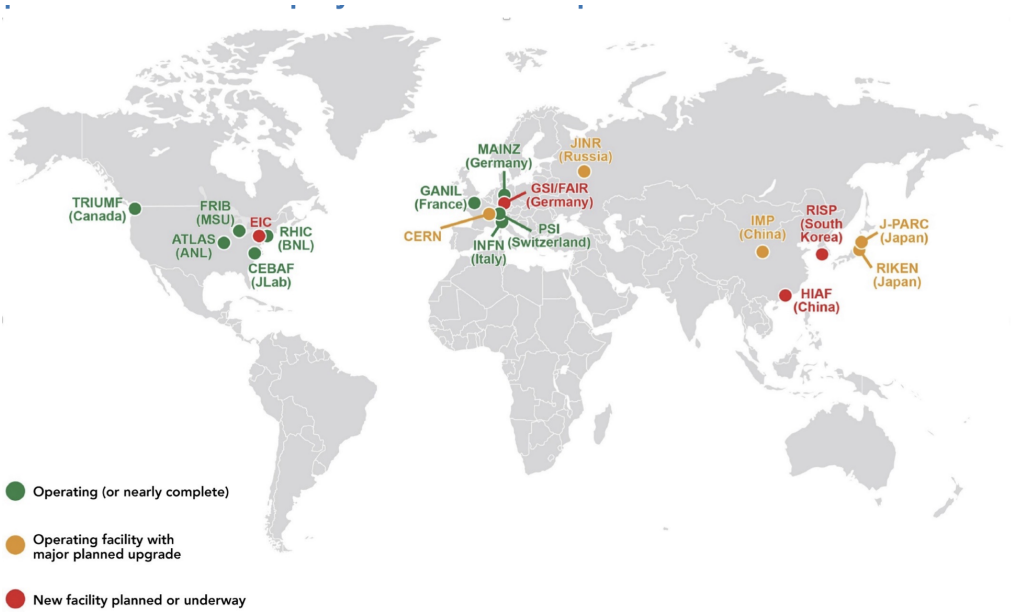
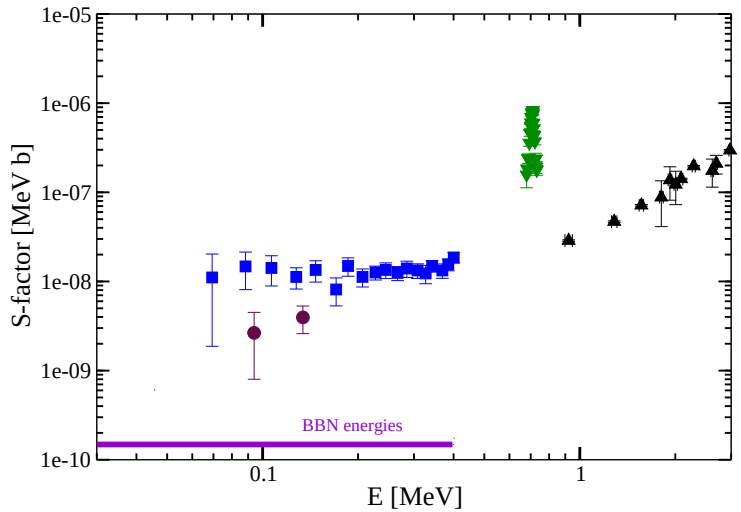
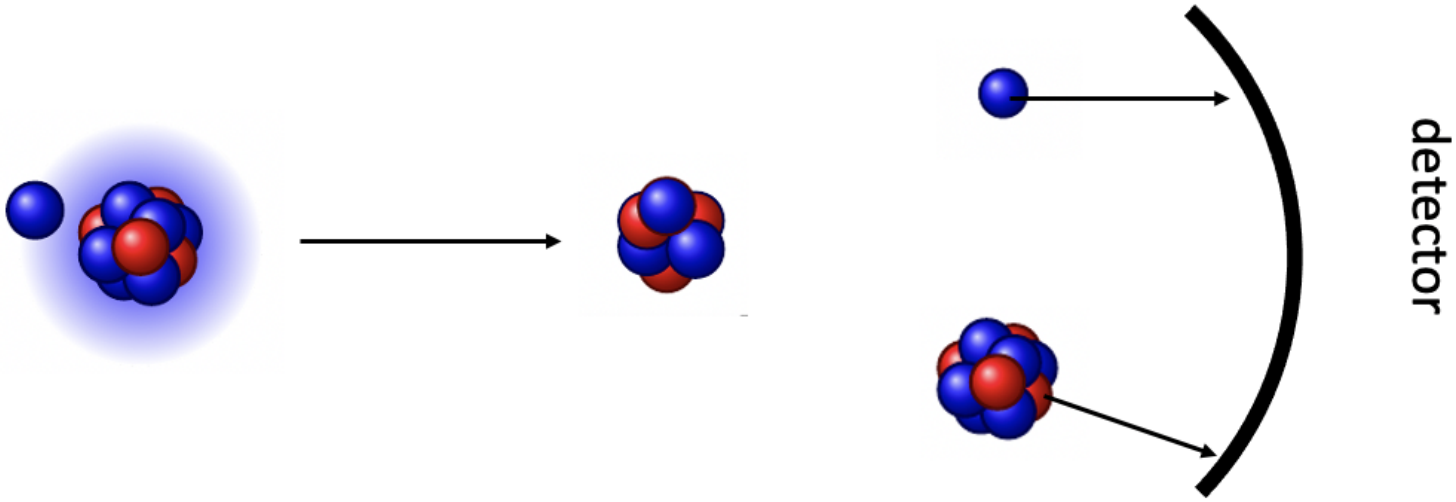




$\alpha(d,\gamma)^6$Li relevant for BBN



My goal is develop accurate & predictive reaction models !



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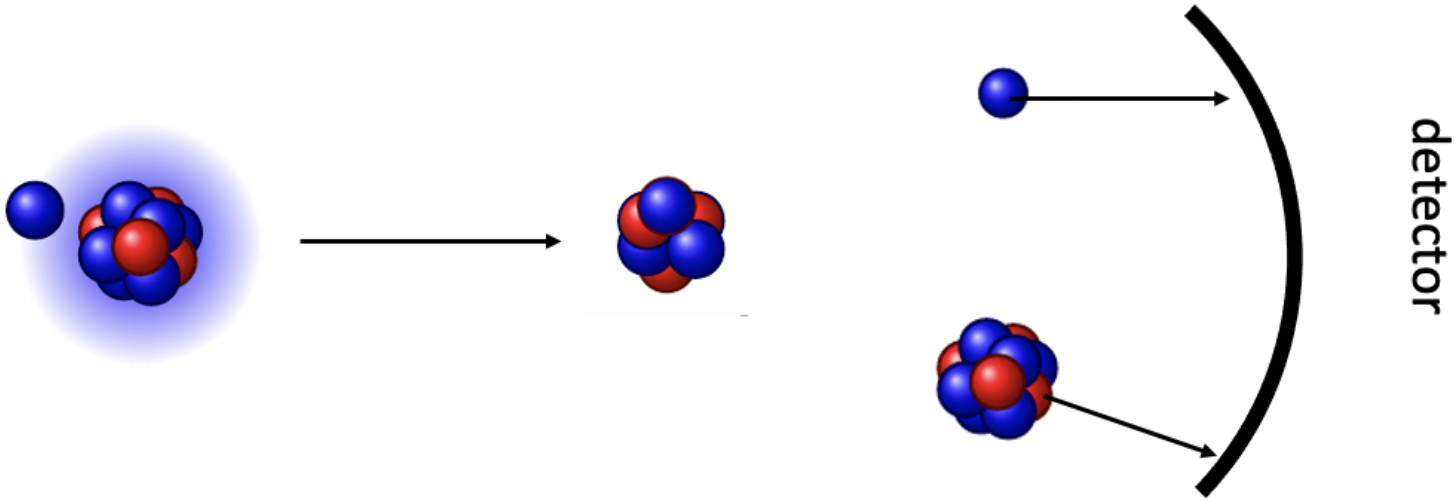

3 ingredients to make accurate predictions :

1) Choose dofs & use an accurate model

2) Interactions grounded in the underlying theory

3) Have an estimate of uncertainties

Ideally, we want to describe all reactions from nucleon's degrees of freedom, with interactions derived from QCD

Ab initio prediction : Many-body methods & χ-EFT interactions

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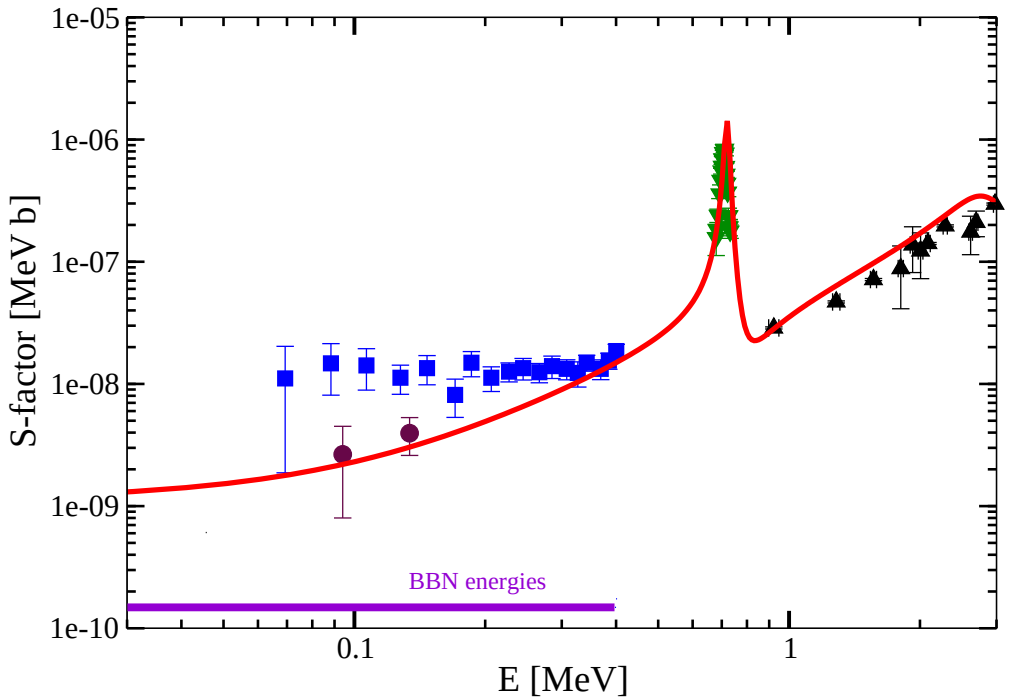
Ab initio prediction : Many-body methods & χ-EFT interactions

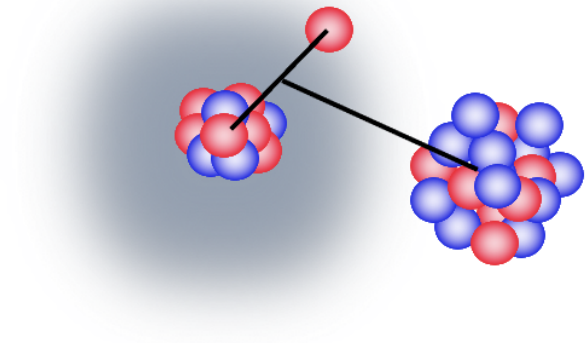
Accurate ab initio predictions fill the experimental gap



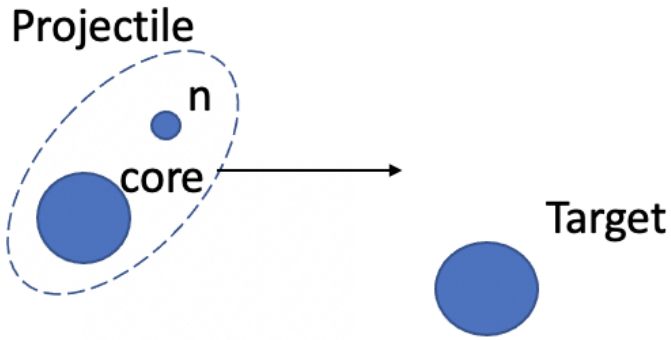
[Hebborn *et al.* PRL **129** 042503 (2022)]

For reactions involving heavier nuclei, one needs to make approximations

light nuclei & low E



heavier nuclei & higher E



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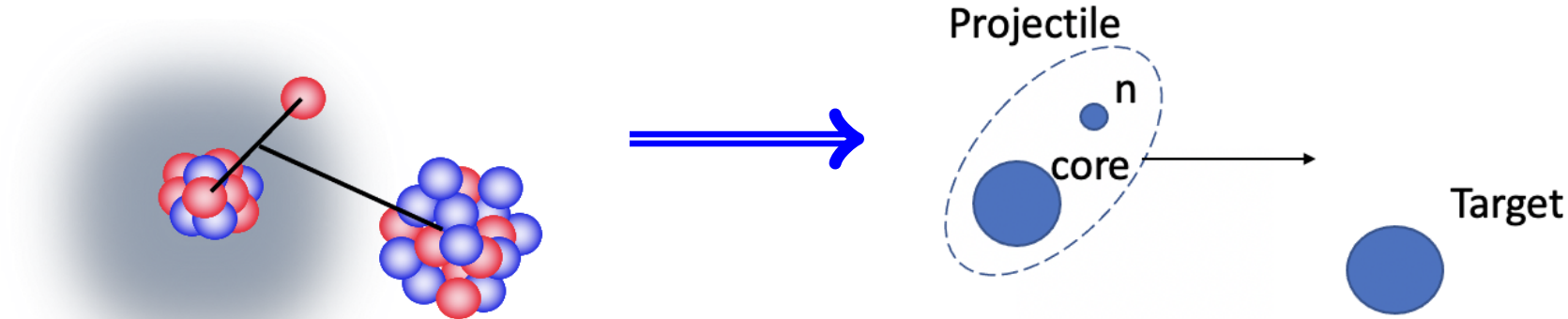


To make accurate reaction predictions :

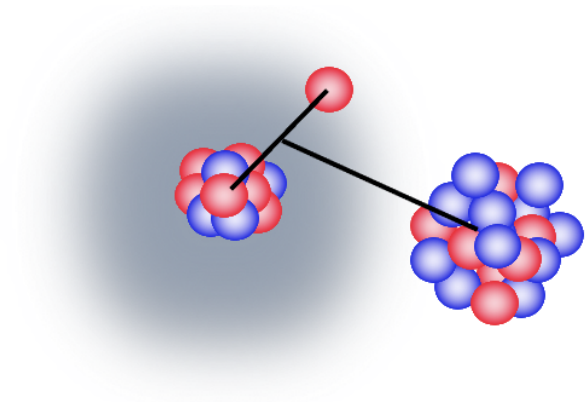
1) Interactions grounded in the underlying theory

2) Choose dofs & use an accurate model

3) Have an estimate of uncertainties

There are still challenges to improve our description of reactions

light nuclei & low E



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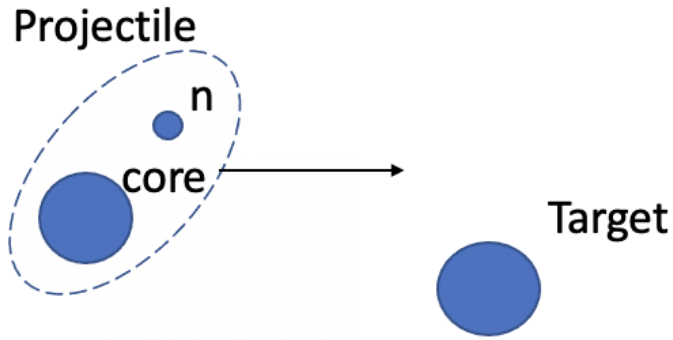

To make accurate reaction predictions :

1) Interactions grounded in the underlying theory
   Integrating EFT potentials
2) Choose dofs & use an accurate model
   Improving eikonal model & 4-body reactions
3) Have an estimate of uncertainties
   Use of modern statistical tools (Bayesian analysis)