

Bayesian Mass Explorer

Cloud Computing Fellowship Symposium



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Facility for Rare Isotope Beams

BMEX Project Goal #1



Build an accessible science gateway
for nuclear properties and theoretical
model predictions

Bayesian Mass Explorer

Compute For:

Single Nucleus

Select Quantity:

All

Select Dataset:

Experiment

Protons:

82

Neutrons:

126

Exp Binding Energy: 1636.4302 MeV

Exp One Neutron Separation Energy: 7.3679 MeV

Exp One Proton Separation Energy: 8.0031 MeV

Exp Two Neutron Separation Energy: 14.1057 MeV

Exp Two Proton Separation Energy: 15.3807 MeV

Exp Alpha Separation Energy: -0.5211 MeV

Exp Two Proton Shell Gap: 6.5983 MeV

Exp Two Neutron Shell Gap: 4.9831 MeV

Exp Double Mass Difference: 0.4269 MeV

Exp Neutron 3-Point Odd-Even Binding Energy Difference

Exp Proton 3-Point Odd-Even Binding Energy Difference

Bayesian Mass Explorer

Compute For:

Isotopic Chain

Select Quantity:

One Neutron Separation Energy

Select Dataset:

SkMs

Protons:

82

Minimum N:

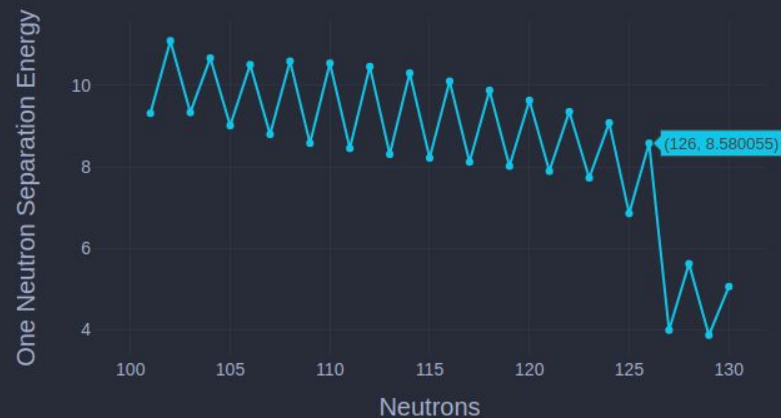
100

Maximum N:

130



Isotopic Chain



BMEX Project Goal #2



Provide an intuitive interface for other researchers to perform simple calculations in the cloud

Bayesian Mass Explorer

Select Quantity:

Two Neutron Separation Energy

Select Dataset:

FRDM

Eta:

2.9

RhoN:

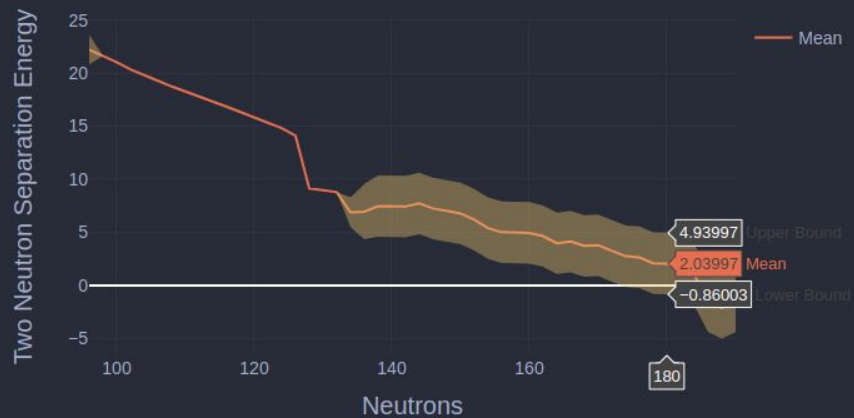
2.529

RhoZ:

0.2533

TRAIN!

Isotopic Chain



Compute For:

Single Nucleus

Select Quantity:

Potential Energy Surface

Select Dataset:

UNEDF1

Protons:

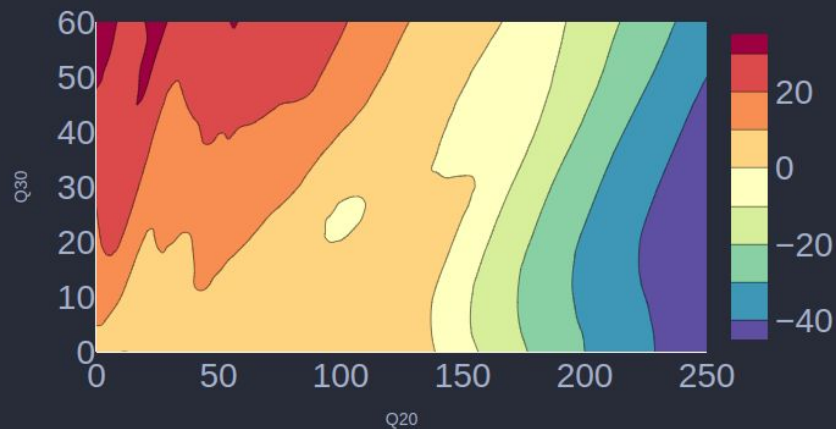
92

Neutrons:

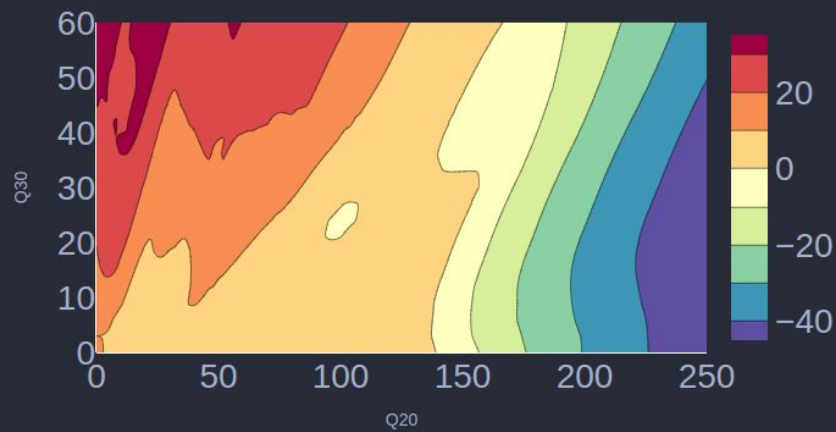
158



PESnet Prediction



True PES



Why Cloud?



Flexible backend

Easily scalable

Enables remote computation

Resources Employed

For landing page:

<https://vercel.com/>



Resources Employed



Welcome to **BMEX!**

Explore masses in the Bayesian way!

Masses →

Binding energies and related quantities for experiment and various models.

Gaussian Process →

Simple Gaussian Process explorer for nuclear models.

PESnet →

Dynamically produce nuclear potential energy surfaces using machine learning.

Resources Employed

For web app:

Azure App Service



Resources Employed

Simple to define custom environment

Quick to spawn instances

Easy to budget



Primary Challenges



Speed vs. Cost

Scaling latency

Managing user state

Primary Outcomes



Service is operational!

Strong interest in the research community

Simple development model means it's easy to contribute to the project

Next Steps



Continue building out current functionality

Consult with community to identify which features should be a priority

Try It Out!



<https://bmex.dev>

<https://github.com/kylegodbey/bmex-web/>

<https://github.com/kylegodbey/bmex-static/>