

## The Problem:

$$H_\theta = H_0 + \sum_i H_i(\theta_i)$$

At least 16, each with an uncertainty!

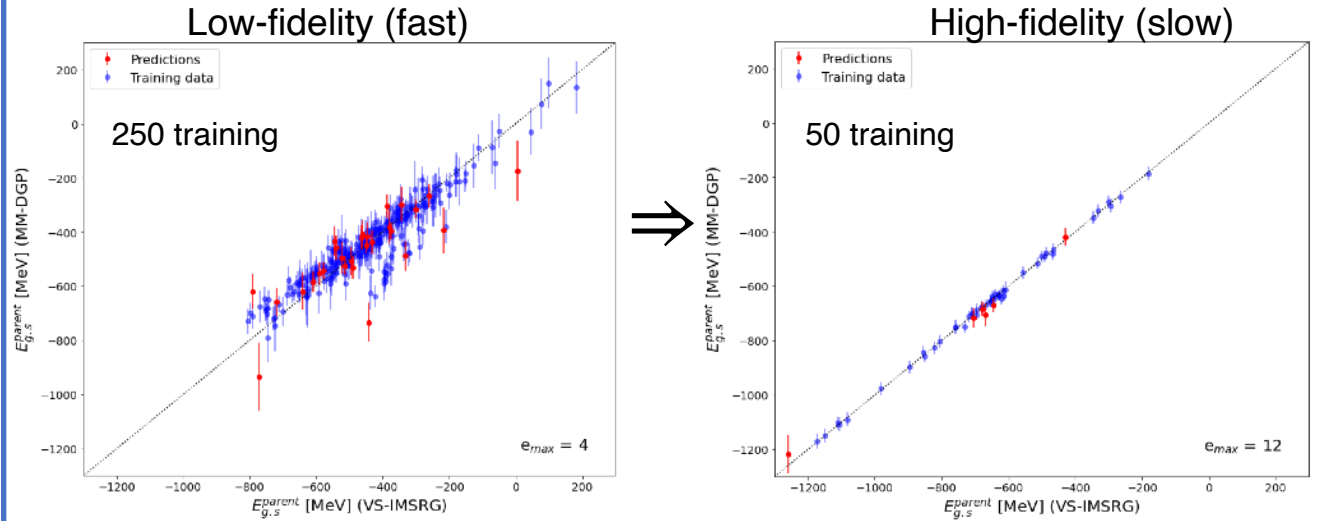
$$H_\theta |\Psi_\theta\rangle = E_\theta |\Psi_\theta\rangle$$

Solving this is really costly and takes a long time ...

$$O(\theta) = \langle \Psi_\theta | O | \Psi_\theta \rangle$$

How to propagate the error of the  $\theta_i$ 's to  $O$ ?

## The Solution: The Multi-Output Multi-Fidelity Deep Gaussian Process (MM-DGP) Emulator



## The Result:

- Use the emulator to sample  $O$  for thousands of values of  $\theta$
- Weight each sample by assessing how they do for few body observables (e.g. phase-shifts)
- Obtain predictive posterior distribution for  $O$  which can be combine with other sources of uncertainties independently!

Once trained, the emulator allows to do this in a few minutes while full calculations would take years!

