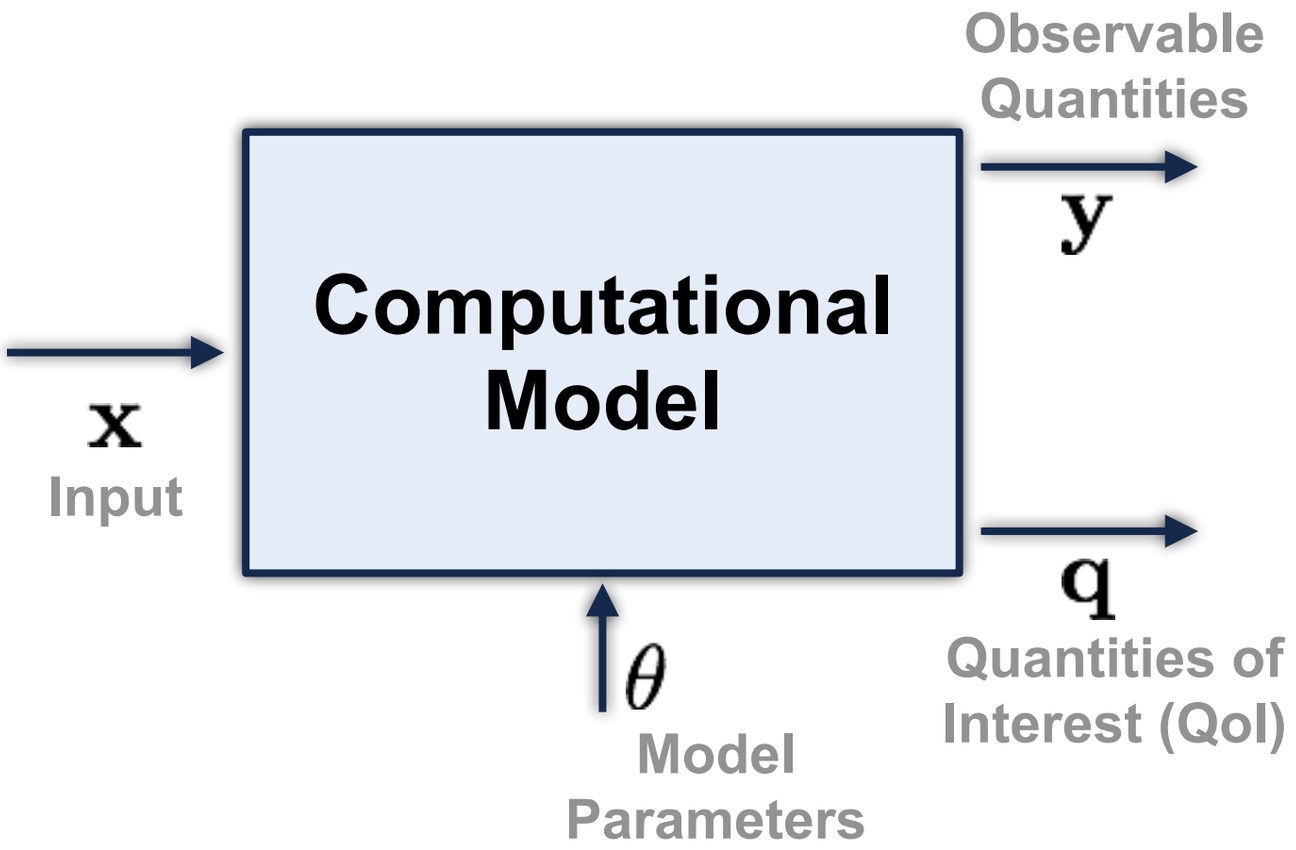
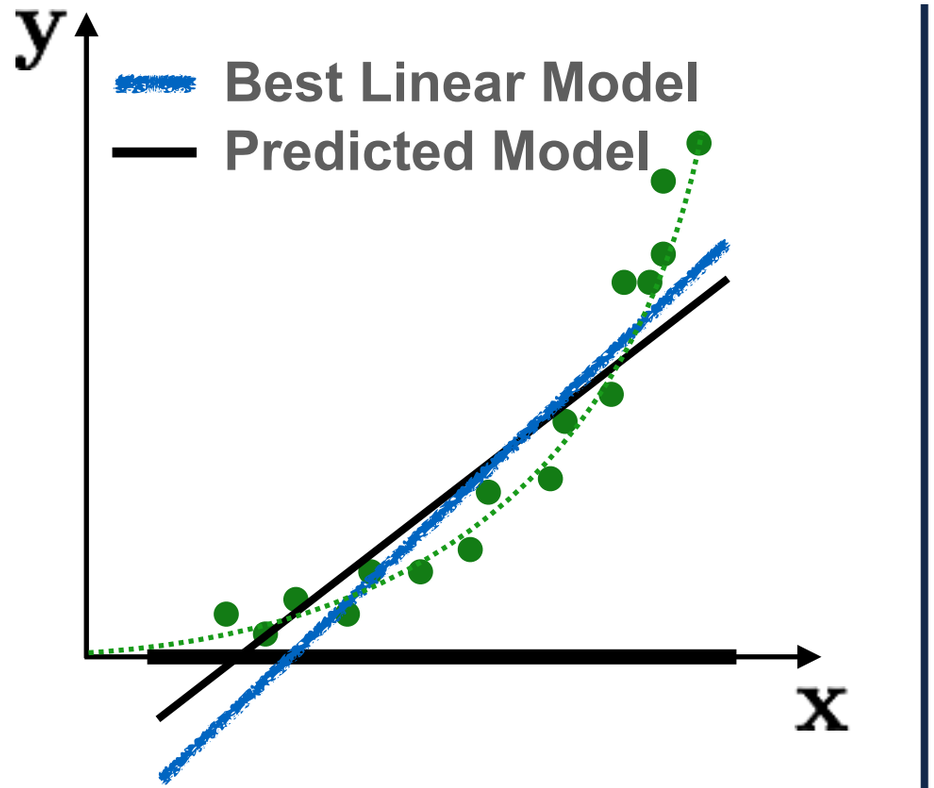
Last Class …

"The ultimate purpose of most computational models is to make predictions, commonly in support of some decision-making process (e.g, for design of operation of some system)." [1]



- **Experimental** or **Measurement** or Observation Error: ● vs ▬ ▬
- Model Uncertainty or **Structural Inadequacy:** ▬ vs ●
- Parameter Uncertainty: ▬ vs ▬

→ **Due to Embedded Model!**

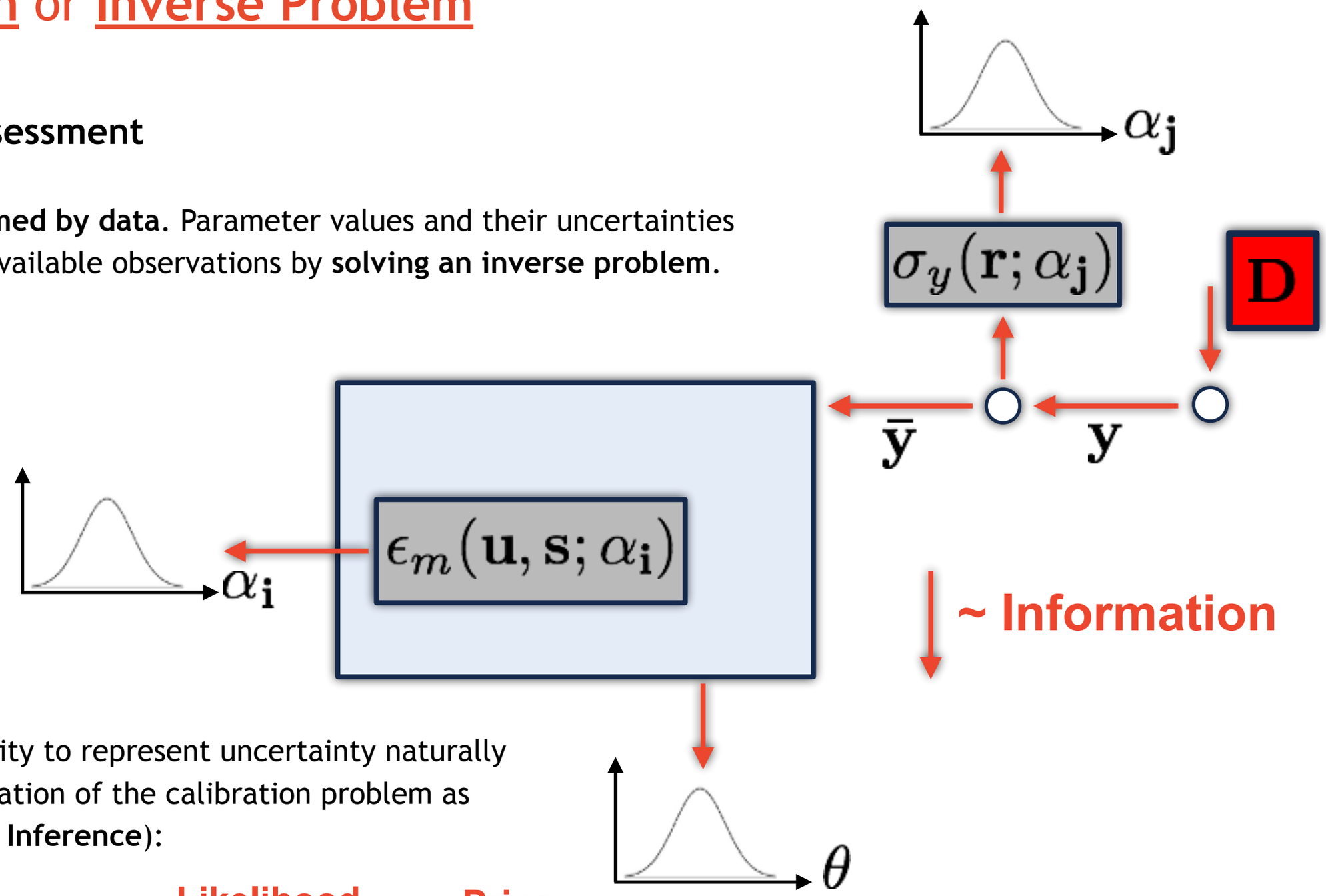


[1] Oliver et al., "*Validating Predictions of Unobserved Quantities*", Computer Methods in Applied Mechanics and Engineering, Vol. 283, 2015.

Last Class …

- Calibration or Inverse Problem
- **Validation**
- **Predictive Assessment**

The model is **informed by data.** Parameter values and their uncertainties are inferred from available observations by **solving an inverse problem.**



The use of probability to represent uncertainty naturally leads to the formulation of the calibration problem as Bayesian (**Bayesian Inference**):

Posterior — Likelihood — Prior

$$p(\theta,\alpha|\mathbf{D},\mathcal{M}) = \frac{\mathcal{L}(\theta,\alpha;\mathbf{D},\mathcal{M})\ \mathbf{p}(\theta,\alpha|\mathcal{M})}{\int \mathcal{L}(\theta,\alpha;\mathbf{D},\mathcal{M})\ \mathbf{p}(\theta,\alpha|\mathcal{M})\ \mathbf{d}\theta\mathbf{d}\alpha}$$