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# QUANTIFYING EPISTEMIC UNCERTAINTIES FOR COMPUTATIONAL PREDICTIONS

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## MINISYMPOSIUM

*We invite talks promoting discussion on methods for estimating epistemic uncertainties and contributions highlighting applications impacted by epistemic uncertainty.* Epistemic uncertainty, i.e., uncertainty due to lack of knowledge, can be caused by diverse sources, such as, sampling uncertainty, approximations and assumptions in the formulation of a mathematical model, and lack of experimental measurement data. As a result, epistemic uncertainty can be difficult to characterize statistically because the lack of knowledge can be extreme in some cases. Bayesian inference is a powerful tool not only for updating uncertainties in model input data, but also in estimating model form uncertainty, also referred to as model discrepancy. However, established methods can be inadequate at estimating simulation uncertainties if large extrapolation from existing experimental data are required or coupled multi-physics interactions are dominant.

The focus of this mini-symposium is improved estimation of epistemic uncertainties in multi-physics simulations, particularly when alternate plausible models are available, sometimes referred to as competing narratives. Epistemic uncertainties are observed across physics disciplines, including turbulence, material fracture, climate, inertial confinement fusion, astrophysics, and materials under extreme conditions. Relevant topics in epistemic uncertainties include:

1. uncertainty in the correct constitutive model form,
2. uncertainty in the physical processes in play and the coupling of those many processes in a complex multi-physics simulation,
3. uncertainty in the physical response due to seemingly conflicting experiments or poorly characterized experiments,
4. uncertainty associated with the experiments being performed at conditions that systematically differ from the target conditions of interest,
5. uncertainty inherited by the requirement to model known physical processes with reduced-fidelity models or models of heterogeneous fidelity, and
6. extrapolation of epistemic uncertainties that are observed at lower-level experiments of a system hierarchy, for example, experiments conducted on subsystems and sub-assemblies.