1142-41-203　　　　**Xiu Yang*** (`xiu.yang@pnnl.gov`), Pacific Northwest National Laboratory, PO Box 999, MSIN: K7-90, Richland, WA 99352. *A Physics Informed Gaussian Process Regression Method with Application to Subsurface Flow.*

In this talk, we introduce a new Gaussian process regression (GPR) method: physics informed Kriging (PhIK). Different from the standard ordinary Kriging, which approximates quantity of interest using stationary Gaussian process (GP), our method constructs a non-stationary GP from realizations of available stochastic models, e.g., from realizations of governing stochastic partial differential equations solutions. Our approach avoids the costly optimization step in data-driven GPR methods to identify the hyperparameters, and accounts for (partial) physical constraints that are included in the stochastic model. The uncertainty of the prediction is intrinsically incorporated in the GPR framework. Also, we extend the PhIK by using cokriging method and design model selection and verification strategies based on maximum likelihood estimate. The efficiency and accuracy of our method are demonstrated for reconstructing a tracer distribution problem in subsurface flow study. (Received September 03, 2018)