Name:	**John J. Molina**	
Affiliation:	Department of Chemical Engineering, Kyoto University	
Email:	john@cheme.kyoto-u.ac.jp	
Academic degree:	PhD in Physical and Analytical Chemistry, Sorbonne Université (2011)	
Professional Experience:	2011 – 2014 Postdoc, Department of Chemical Engineering / Fukui Institute for Fundamental Chemistry, Kyoto University 2014 – Assistant Professor, Department of Chemical Engineering, Kyoto University	
Current Research:	Physics Informed Machine Learning for Soft Matter Dynamics of (Active) Colloidal Dispersions	

Machine Learning Physics for Flowing Soft Matter

John J. Molina[1], Kenta Ogawa[1], Souta Miyamoto[1], and Takashi Taniguchi[1]

[1] Department of Chemical Engineering, Kyoto University, Kyoto 615-8510, Japan

We provide two examples that show how Machine Learning can be fused with Computational Physics, in order to develop methods that are drastically faster and/or more robust[1,2]. In particular, we consider how to (1) learn the constitutive relation for the stress of polymer flows with memory from microscopic data, as well as (2) infer the solution to a Stokes flow problem given knowledge of the boundary conditions. In both cases, we use a probabilistic machine learning framework based on Gaussian Processes, which allows us to easily handle missing and/or noisy data, as well as to directly encode physical laws into the inference framework. Our predictions are compared to established methods and analytical solutions (where available), showing excellent agreement. Finally, we discuss further improvements and applications.

[1] N. Seryo, T. Sato, J. J. Molina, T. Taniguchi, *Phys. Rev. Res.* **02**, 033107 (2020)

[2] N. Seryo, J. J. Molina, T. Taniguchi, *Nihon Reoroji Gakkaishi* **49**, 97-113 (2021)