## Machine Learning Conference for X-Ray and Neutron-Based Experiments, Munich 2024



Contribution ID: 17 Type: Poster

## CrysFieldExplorer: Rapid Optimization of the Crystal Field Hamiltonian

Tuesday 9 April 2024 17:30 (20 minutes)

We present a new approach to the fast optimization of crystal electric field (CEF) parameters to fit experimental data. This approach is implemented in a lightweight Python-based program, CrysFieldExplorer, using Particle-Swarm-Optimization (PSO) and covariance matrix adaptation evolution strategy (CMA-ES). The main novelty of the method is the development of a unique loss function, referred to as the spectrum characteristic loss, which is based on the characteristic polynomial of the Hamiltonian matrix. Furthermore, this optimization technique can be generalized to optimize spin wave excitations by performing optimization on multiple exchange Hamiltonian matrices at multiple Q positions in reciprocal space.

The research at ORNL was supported by the DOE, Office of Science, Office of Advanced Scientific Computing Research (contract No. ERKJ387 to Guannan Zhang), and Office of Basic Energy Sciences, Early Career Research Program (award No. KC0402020 to Huibo Cao under contract No. DE-AC05-00OR22725).

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Session Classification: Posters

Track Classification: MLC