Kyungmin Lee

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PROFESSIONAL SUMMARY

Expert in numerical methodologies in theoretical physics of quantum materials. Studied novel phenomena in quantum systems using numerical techniques including spectral analyses, Monte Carlo simulations, and optimizations. Completed several large-scale numerical computation projects. Expert in C++, Python, and Julia.
International Physics Olympiad Silver Medalist

TECHNICAL SKILLS

C++ (Proficient), **Python** (Proficient), **Julia** (Proficient), **CUDA** (Familiar), **MPI** (Familiar)

EDUCATION

2009–2016   **Ph.D. in Theoretical Physics, Cornell University, NY**
- Advisor: Prof. Eun-Ah Kim
- Thesis: *Theoretical Studies on Electronic Spectra of Heterogeneous Unconventional Superconductors*

2002–2009   **B.S. in Physics, B.S. in Computer Science and Engineering (Dual Major), Seoul National University, South Korea**
- GPA: 4.06/4.30 (Graduated with *summa cum laude*)
- Dissertations:
  - CSE: *Ground State of Edwards-Anderson Ising Spin Glass Model: Computational Complexity and Genetic Algorithmic Approach*

PROFESSIONAL/RESEARCH EXPERIENCE

2019–present   **Postdoctoral Scholar in Condensed Matter Theory, National High Magnetic Field Laboratory, Florida State University, FL**
- Studied quantum thermalization using matrix eigendecomposition with dimensional reduction using (Abelian & non-Abelian) space group (Julia).
- Quantum tensor-network-based optimization / time-evolution techniques (C++, Julia).
- Developed 100k+ line Julia libraries for efficient representation of generic interacting quantum mechanical Hamiltonians with nontrivial statistics (bosonic and fermionic) and dimensionality reduction using group theoretical techniques (~30x dimension reduction).

2016–2019   **Postdoctoral Researcher in Condensed Matter Theory, The Ohio State University, OH**
- Studied topological phases of matter with *high-dimensional optimization using iterative methods* (Julia).
- Studied adaptomic structure formation using *simulated annealing* (Julia).

2010–2016   **Research Assistant in Theoretical Physics, Cornell University, NY**
- Investigated quantum mechanical systems using
  - Determinant quantum Monte Carlo (Metropolis-Hastings) algorithm (C++, Fortran)
  - High-dimensional optimization using iterative methods (C++ with OpenMP/TBB & MPI, Python with Cython).
  - Spectral analysis using GPGPU programming (C++ with CUDA, Python)
  - Matrix eigendecomposition and dimensionality reduction Krylov space techniques, making use of translation (Abelian) symmetry (C++ with PETSc/SLEPc over MPI, Python)
  - Variational Monte Carlo (Metropolis-Hastings, ~2 billion steps) algorithm (C++ with TBB, Python with Cython)
- Developed 50k+ lines of Python code for statistical analysis and prototyping for C++.
- Developed 100k+ lines of C++ code for high performance numerical methods in quantum mechanics to run on HPC clusters (spectral analysis, Monte Carlo, optimization).
- Used CUDA for massively parallel matrix spectral analysis.
- Used MPI with C++ for large-scale eigendecomposition on HPC clusters.

AWARDS

2001   **32nd International Physics Olympiad – Silver Medal, Antalya, Turkey**
2000   **31st International Physics Olympiad – Honorary Mention, Leceister, UK**

PERSONAL SOFTWARE PROJECTS

- Numerical Method Packages used for Quantum Materials written in Julia (https://github.com/kyungminlee)