AI 4 Quantum

DRESDEN concept

CASUS CENTER FOR ADVANCED SYSTEMS UNDERSTANDING

ScaDS.AI DRESDEN LEIPZIG

Machine learning for quantum simulation and quantum computing

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Publications @ Google Scholar

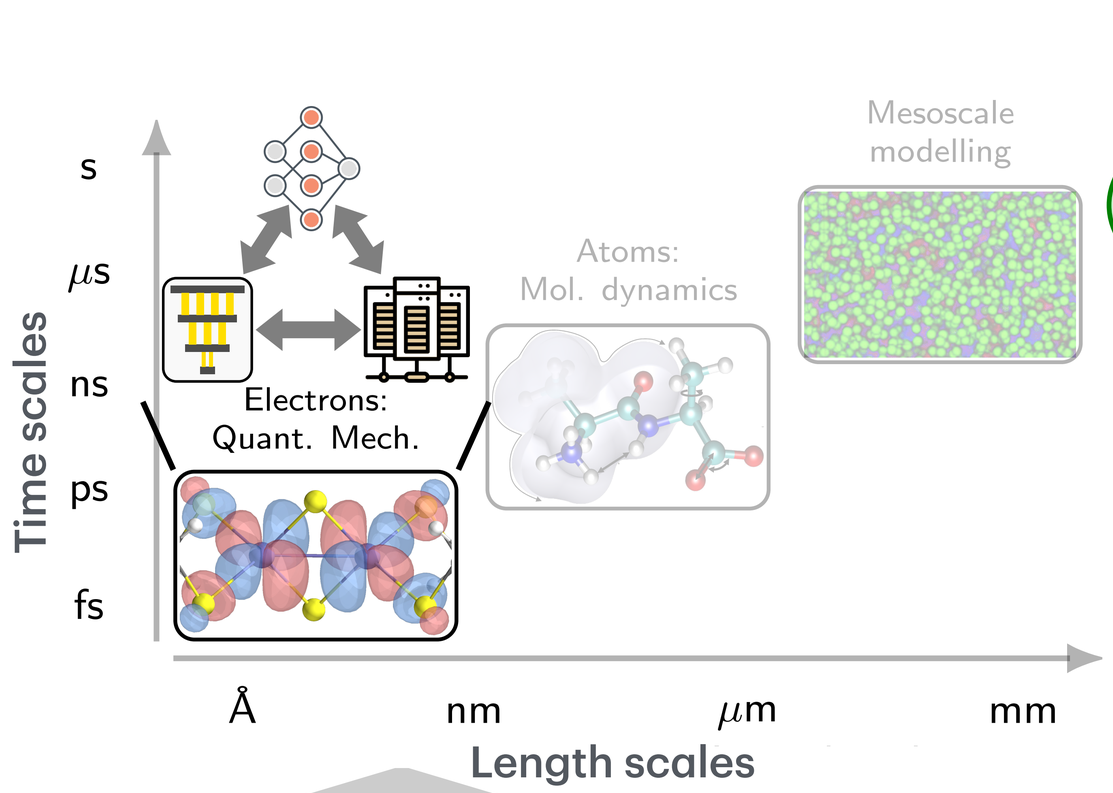
Personal Homepage / Institute Homepage

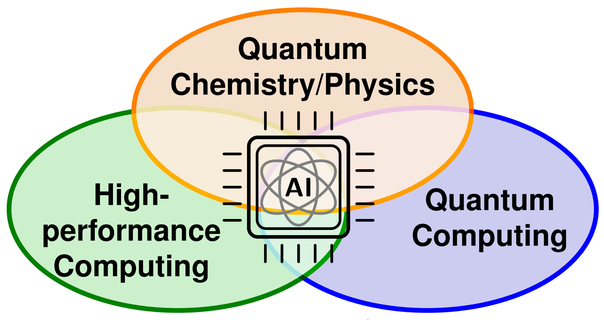
Supported by:

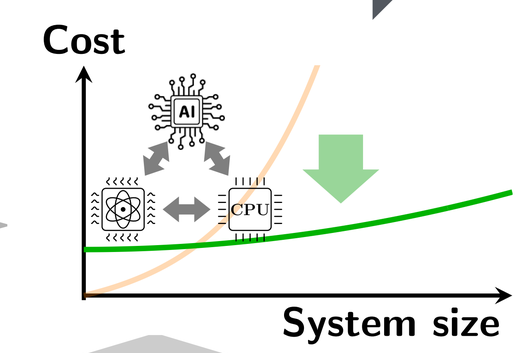
- BMFTR Junior Research Group
- Helmholtz Young Investigator Grant
- DRESDEN-concept Research Group Leader

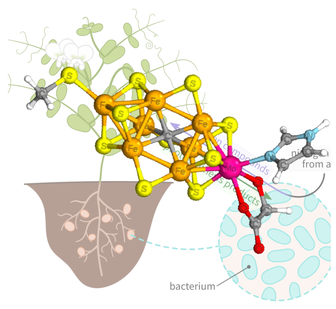
Bundesministerium für Forschung, Technologie und Raumfahrt

quanten technologien — Quantum Future Junior Research Groups

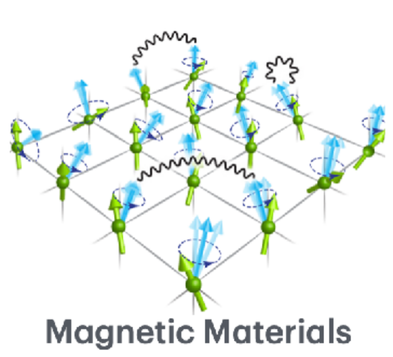




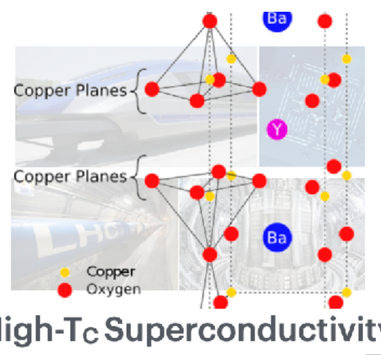




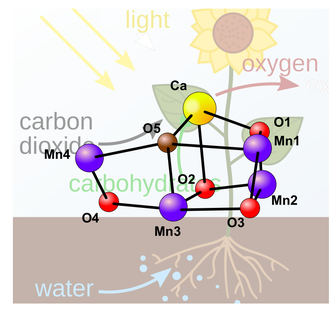
Nitrogen fixation



Magnetic Materials



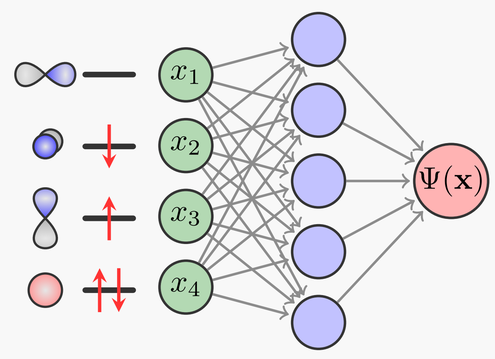
High-T_C Superconductivity



Artificial photosynthesis

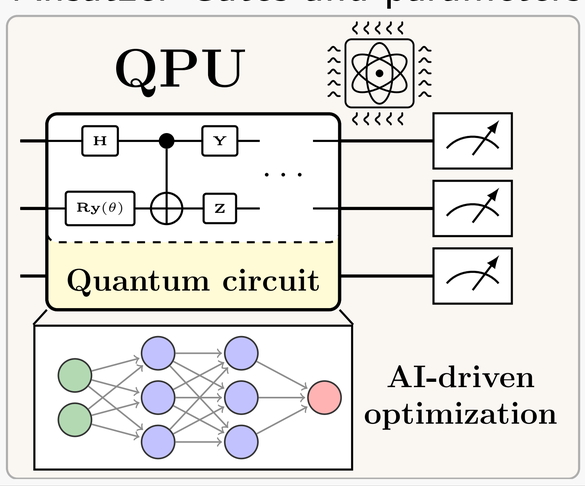
Neural Network States for Quantum Matter

- **Compress** exponential complexity of target solution, $\Psi(\mathbf{x})$
- **Resource reduction**: physics-informed, symmetry-preserving neural quantum states



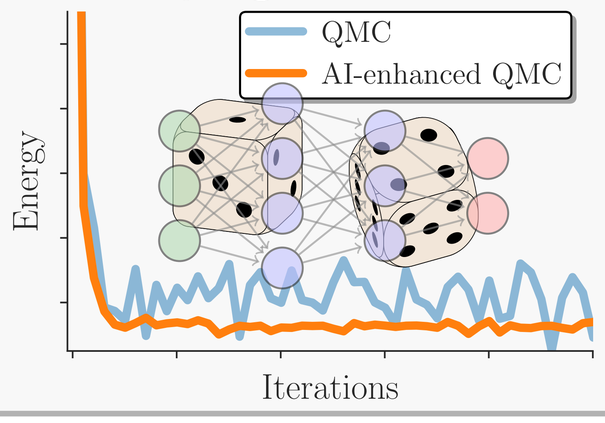
AI-driven Quantum Computing Approaches

- Increase **noise-resilience** and optimization of quantum algorithms
- **ML optimization** of quantum Ansätze: Gates and parameters



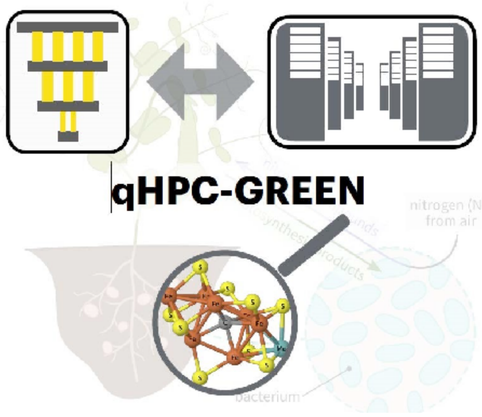
AI-enhanced Quantum Monte Carlo Methods

- **Extend reach** and acc. of QMC: AI-enhanced sampling of exponential state space
- Big data ML approach for **optimal sampling**



HPC+QC algorithms toolkit to study strongly correlated electron problems

Simulation of bio-chemical transition metal compounds relevant for the **green energy transition**



Gefördert durch:

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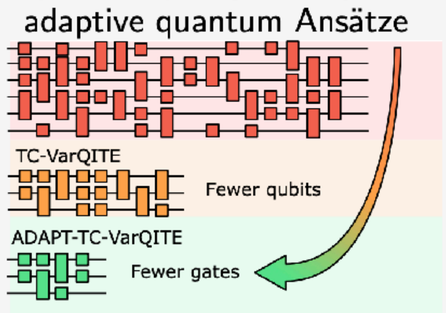
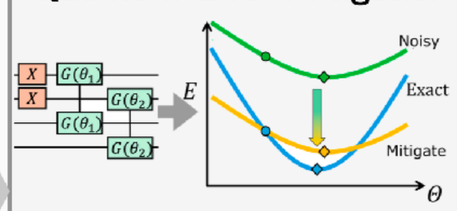
WP1

Resource Reduction

- Accurate calculations for relevant problems on current and future NISQ devices
- Transcorrelation, active spaces, spin-symmetry and adaptive quantum Ansätze

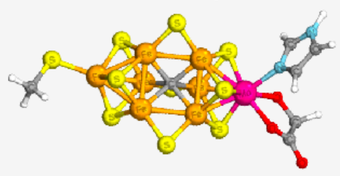


Quantum Error Mitigation



Relevant Applications:

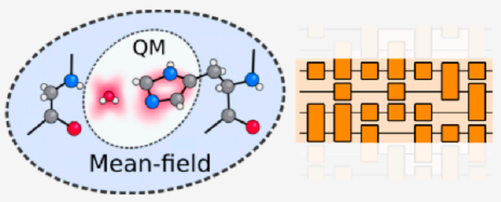
Electronic structure of transition metal compounds



WP2

Algorithms and Software for relevant insights:

- Electronic properties
- Excited states
- Quantum embedding
- Efficient QC+HPC implementation



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TECHNISCHE UNIVERSITÄT DRESDEN

CBG Max Planck Institute of Molecular Cell Biology and Genetics

UFZ HELMHOLTZ Centre for Environmental Research

Uniwersytet Wrocławski

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SACHSEN This project is co-financed by the Saxon State government out of the State budget approved by the Saxon State Parliament