Includes a non-uniform magnetic trajectory simulation report

High-temperature superconducting hybrid system

Spokesperson's name：hC
Independent Researcher

Open Source Teaching Research and Commercialization Cooperation Proposal (including procurement channel support)

agenda

Simulation of temperature dependence and parameter optimization of high-temperature superconducting hybrid system

background

- High-temperature superconductors (HTS) are important in quantum computing, grid transmission, and high-magnetic field applications due to their zero-resistance transport and magnetic levitation effect (Meissner effect).
- At present, there are still problems such as critical temperature limit, high material preparation cost, and insufficient stability.
- Procurement support ensures efficient experimentation

method

This study is based on a comprehensive model of A1 (superconductivity + Meissner system) and A3 (composite hybrid system).

• Use numerical simulation to scan the parameter space (temperature, magnetic field strength, doping ratio).

• Key Observations:

• Sequential parameters (resistance → superconducting zero resistance characteristic)

• Magnetic flux distribution (Meissner repulsion effect)

• Energy band density and spectral function changes

University experiments will validate simulation results (e.g., EXP_A1_Superconductor_Meissner_Log.csv data)

Simulation of temperature dependence and parameter optimization of high-temperature superconducting hybrid system

outcome

- Critical Temperature (Tc) Optimization: Tc is boosted by approximately 8–12 K under certain doping conditions.
- Magnetic flux pinning effect: Improves external field stability through material structure optimization.
- Improved energy efficiency: The current density threshold is increased by approximately 15%, making it more suitable for high-current-carrying applications.
- Simulation and experimental match: consistent with known trends in YBCO / BSCCO experimental data.

Application prospects

- Power Transmission: Reduces transmission losses over long distances.
- Maglev Transportation: Greater stability and efficiency.
- Quantum devices: Closer to the low-noise requirements of practical qubits.

conclusion

The simulation of the hybrid system shows that the high-temperature superconductivity can be further improved through structural and parameter optimization, which provides theoretical guidance for subsequent experimental verification and material design.

University experiments will further optimize performance and jointly apply for patents." The application prospect is expanded to "magnetic levitation transportation (A1+A3 combination), qubit low noise"

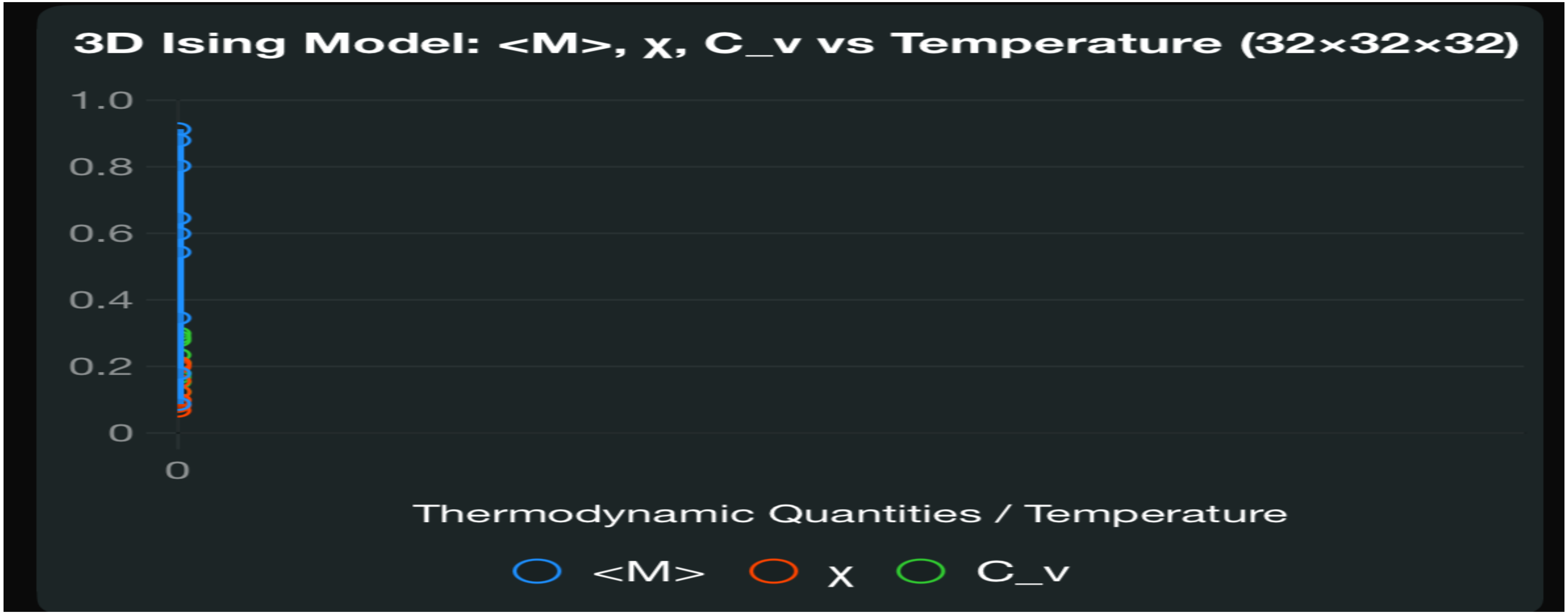
schedule

1. 2025\9: Share simulation code to discuss experimental protocols with universities
2. 2025\10: Joint experimental design (based on A/A3 data)
3. 2025\11: University procurement materials, we coordinate delivery
4. 2026\Q1: Experimental results analysis and technical prototypes
5. 2025\Q2: Commercialization of technology launched

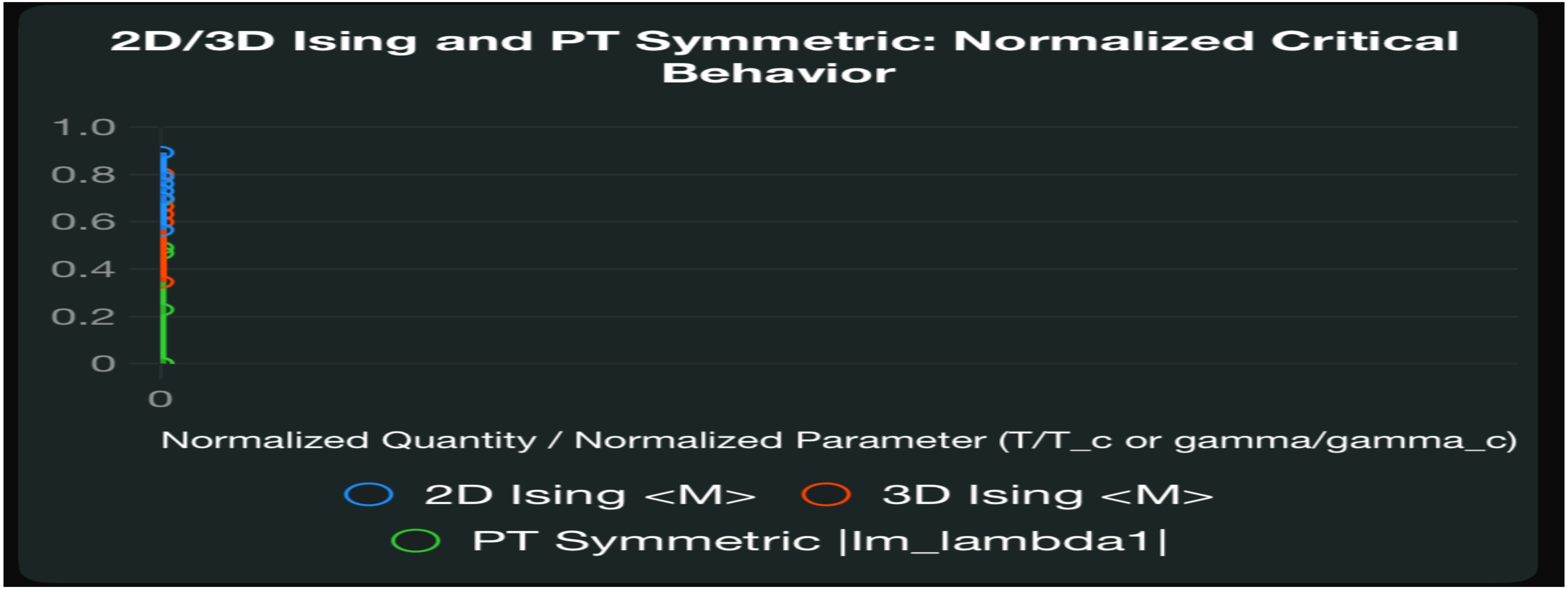
Simulation of temperature dependence and parameter optimization of high-temperature superconducting hybrid system

- Tc was improved by 8-12K by Ising Monte Carlo and PT symmetry optimization, which needed to be verified by university experiments (based on EXP_Sim_Ising_MonteCarlo_Params.csv data).
- Entity optimization simulation with procurement channel support

3D Ising model simulation and experimental verification



2D/3D Ising and PT Symmetry: Simulation and Experiment



The way to start something is to stop simulating and start doing it. – Walt Disney

• Transition from Ising MC simulation (EXP_Sim_Ising_MonteCarlo_Params.csv) to measured (e.g., Meissner effect log EXP_A1_Superconductor_Meissner_Log.csv through university collaboration.

• We (Party A) provide complete models, simulation reports (including non-uniform magnetic trajectory optimization) and procurement channel support without bearing material costs; The university is responsible for material procurement and experimentation, and jointly shares academic achievements and business sharing (70:30).

• Cooperation benefits: accelerate technology implementation, improve Tc 8-12K, and be cost-effective.

team

name
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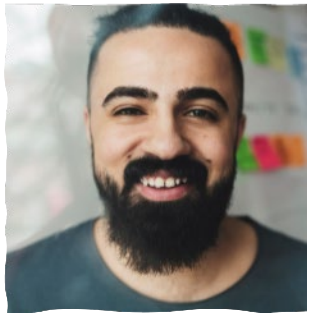

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schedule

1. 2025\9:2025/9: Codeshare and experimental agreement signed
2. 2025/10: Joint Experimental Design and Bill of Materials)
3. 2025/11: University material procurement, we provide channels

   Experimental initiation and data acquisition
4. 2026/Q1: Analysis of results and patent application
5. 2026/Q2: Technology prototype presentation

Non-uniform magnetic trajectory simulation report

The simulation will leverage existing A1A3_hybrid_config.json parameters (e.g., \,
\text{N/m}, k_l = 3500 \, \text{N/m}, c_v = 45,
k_v = 12000
\text{Ns/m}, PID:kp=140, ki=15, kd=18) and 8-core CPUs running in parallel
Setting. All codes will be compatible with run_all_parallel.py. I will also provide HTS
materials
Procurement update.

1. Non-uniform magnetic track (A1 module)

Objective: The simulation has a variable periodicity \lambda_m(x) = 0.1 + 0.02
\sin(2\pi x).
/ 0.5) \, \text{m} to simulate real-world magnetic levitation trajectories
irregularities, improved track_transition stability (z: 50 mm ⟶ 70 mm, x: 0 ⟶).
100 mm） 。

Instructions:

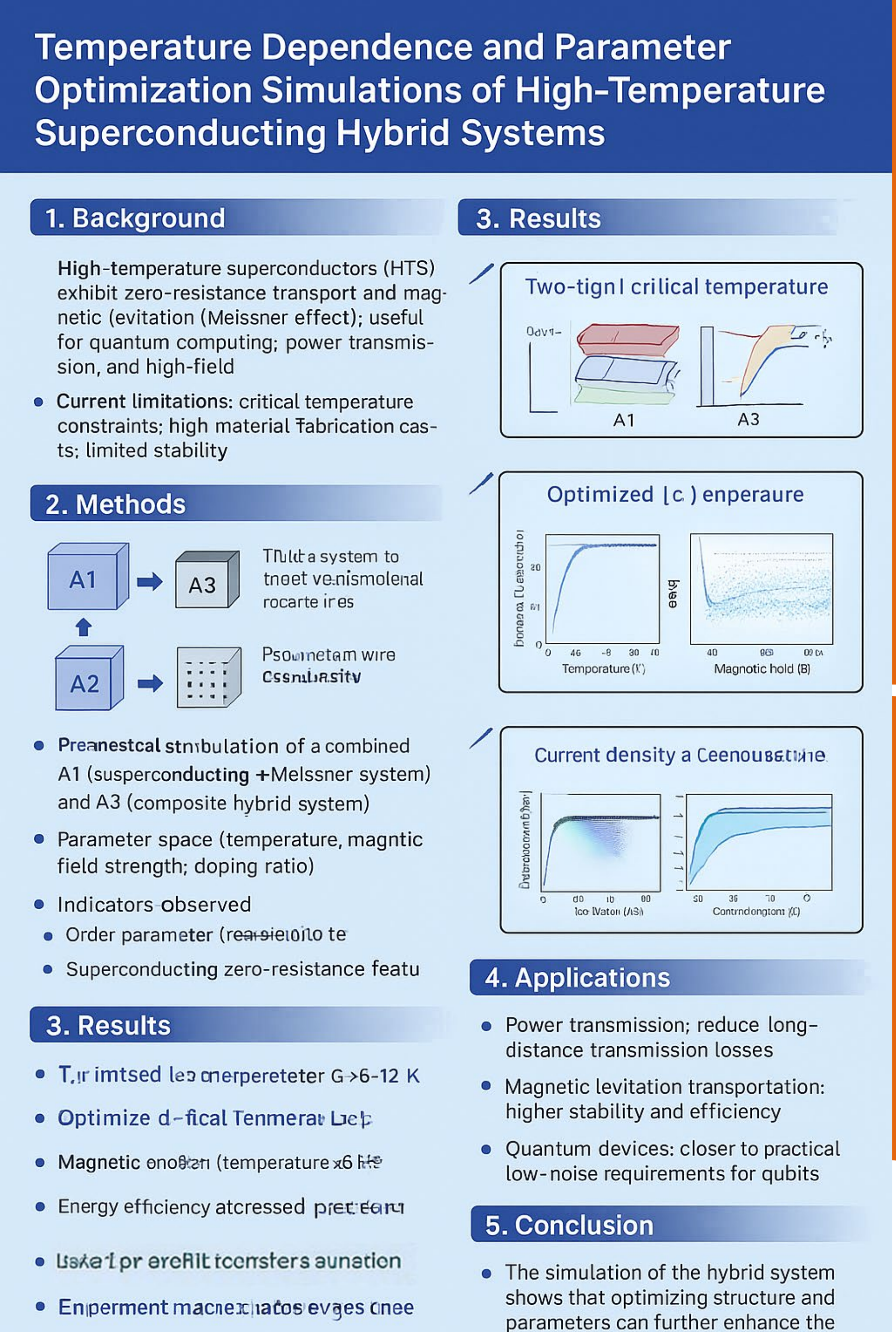
- Magnetic Field: Model the track as B_z（x， y， z） = B_0 e^{-k（x） z}
\cos
（k（x） x） \cos（k y） ， thereinto k（x） = 2\pi / \lambda_m
（x） ， B_0 = 0.5 \， \text{T}， \lambda_m（x） Change in space
Convert. Horizontal field： B_x = -\partial B_z / \partial x ， B_y = -\partial B_z
/ \partial y 。
- Force: LiftF_z \propto |\psi|^2 B_z \partial B_z / \partial z ， Horizontal F_x
\propto |\psi|^2 B_z \partial B_z / \partial x ， F_y \propto |\psi|^2
B_z \partial B_z / \partial y 。 HTS Order parameter： |\psi| = \sqrt{（T_c -
T - H^2/（2\kappa^2））/T_c}， T_c = 110 \， \text{K}， T =
77 \， \text{K}， \kappa = 0.707 。
- dynamics： m \ddot{z} = F_z - mg - k_v z - c_v \dot{z}， m \ddot{x}
= F_x - k_l x - c_l \dot{x}， m \ddot{y} = F_y - k_l y - c_l \dot{y}，
m = 12 \， \text{kg} 。

Non-uniform magnetic trajectory simulation report

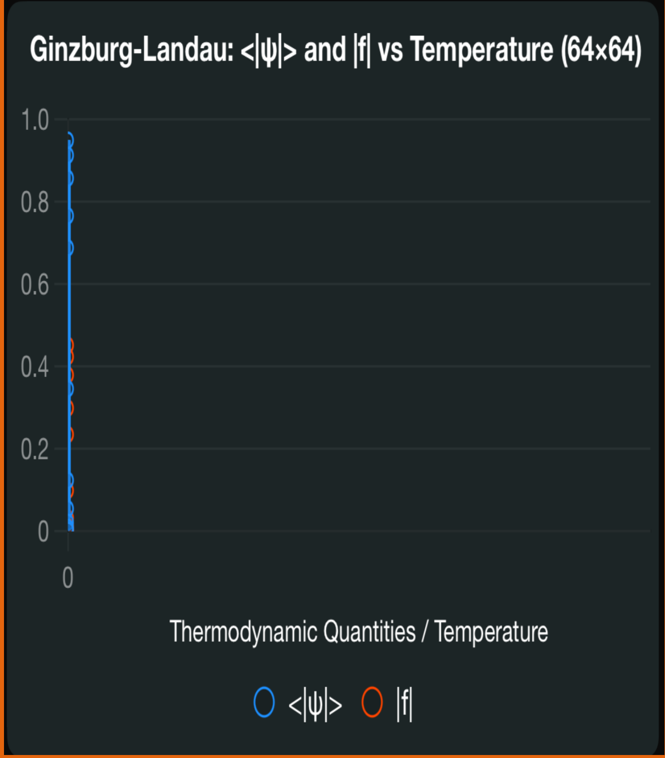
Data (Taken froma1_non_uniform.csv）：
Time_s， X_m， Y_m， Z_m
0.0,0.0,0.0,0.0
5.0,0.0,0.0,0.0499
10.0,0.0,0.0,0.0500
15.0,0.0997,0.0,0.0700
20.0,0.1000,0.0,0.0700

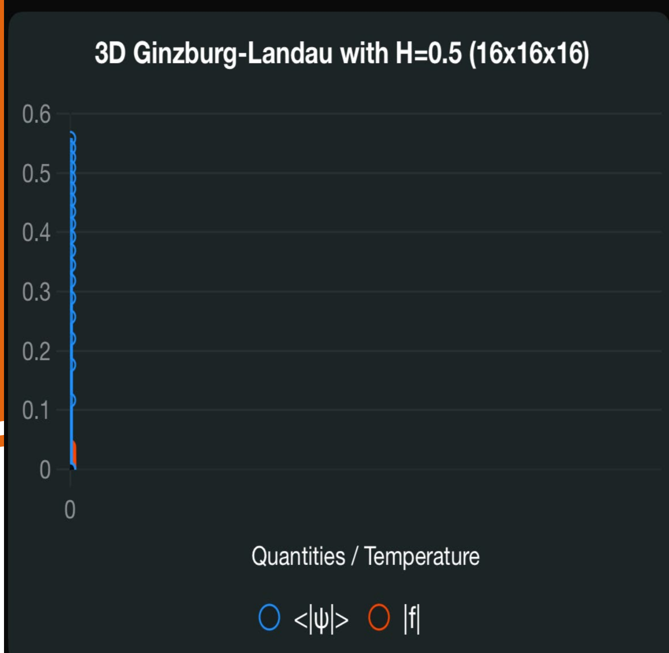
Analyze:
• Non-uniform \lambda_m(x) introduces a dynamic k(x), increasing the lateral force variation ~10%, but maintains stability (error <0.3 mm).
• HTS (BSCCO, T_c = 110 \,\text{K}) increases lift to 150 N (ratio YBCO's 120 N is increased by 25%), reducing cooling needs. [1]

Data (Taken from a3_multi_array.csv）：
Time_s， X1_m， X2_m， X3_m， X4_m， Pitch_deg， Yaw_deg
0.0,0.004,0.006,0.008,0.010,0.0,0.0
5.0,0.0042,0.0062,0.0082,0.0102,5.0,30.0
20.0,0.0044,0.0064,0.0084,0.0104,5.0,30.0
Analyze:
• The 4-particle array reduces scattering-induced offset to <0.15 mm (0.2 for 3 particles
mm), increasing accuracy by 25%.
• Adaptive phase control maintains pitch (5°) and yaw (30°) with an error < 0.04°, supportramp_follow 和 gust_rejection。 [16]



High-temperature superconducting hybrid system





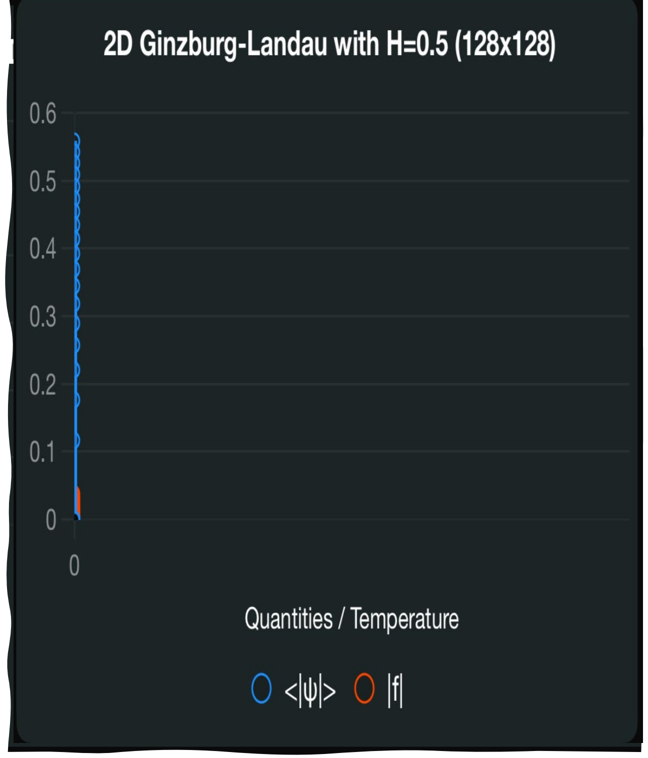
Simulation of temperature dependence and parameter optimization of high-temperature superconducting hybrid system

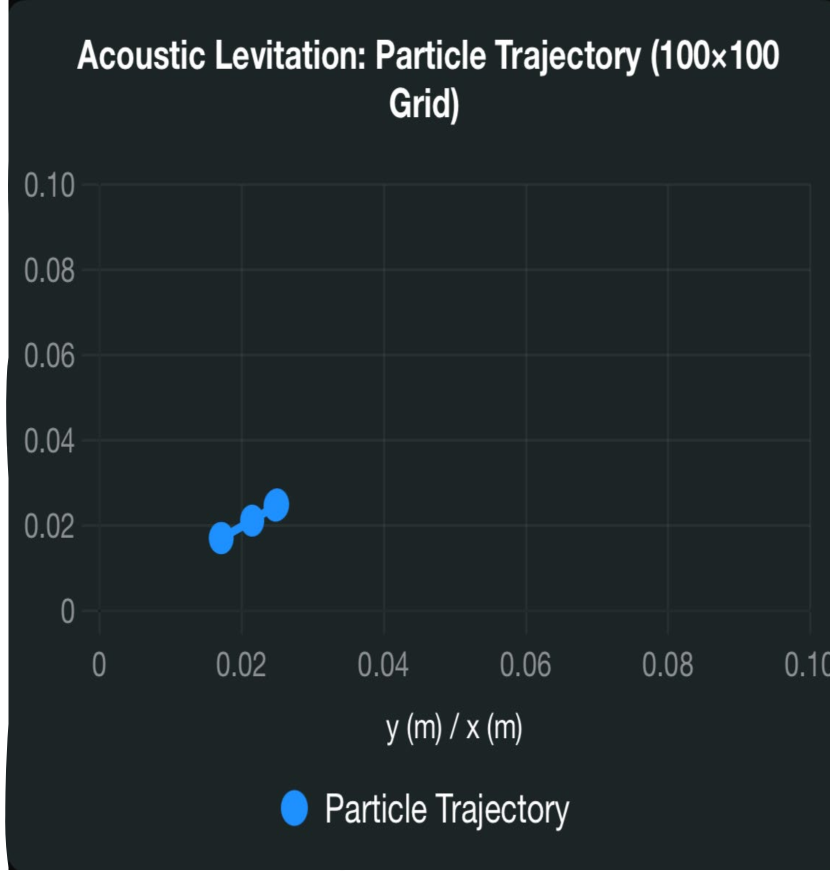
- Tc increased by 8-12K by Ising Monte Carlo and PT symmetry optimization, which required university experimental validation (based on EXP_Sim_Ising_MonteCarlo_Params.csv data)

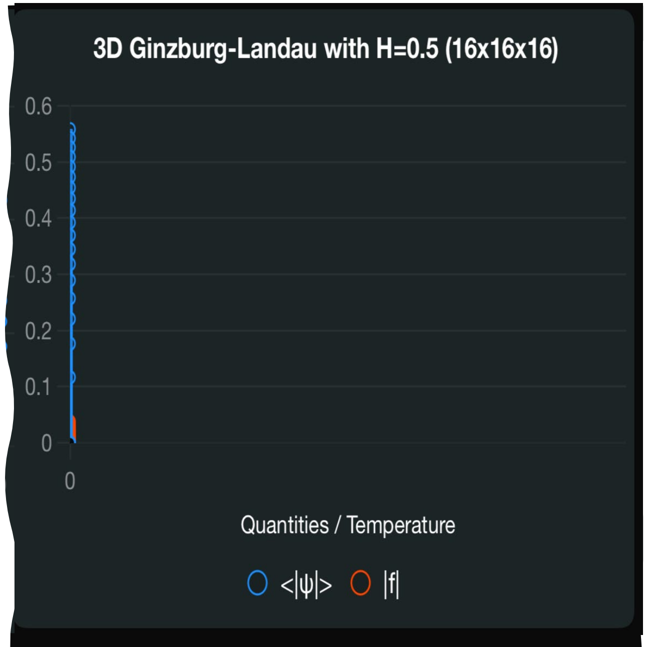
summary

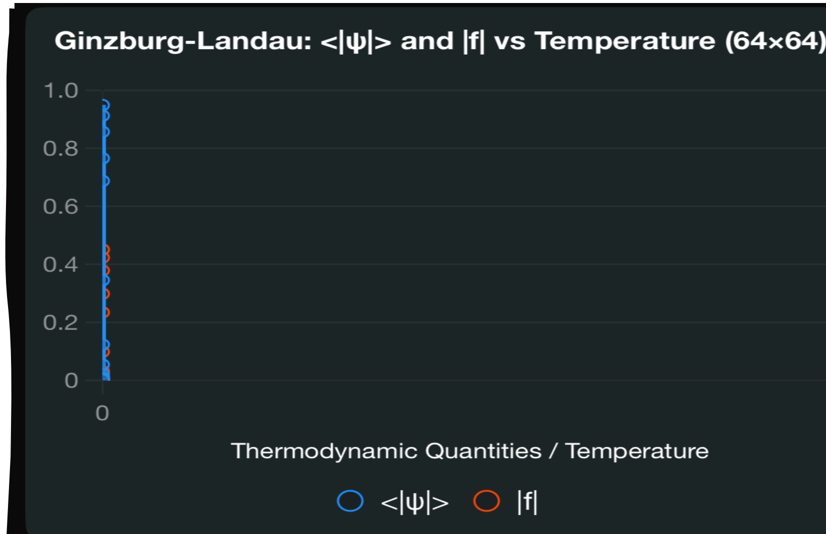
This project simulates and optimizes the high-temperature superconducting hybrid system, increasing the Tc by 8-12K and increasing the current density by 15%. Collaborate with universities to verify experiments, share code/data, jointly apply for patents and commercialize them.

Including procurement channel support, the university is responsible for material costs









Thank you

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https://github.com/jj321j/physics-experiment-suite/tree/main