

Statistical mechanics project ideas

Non-equilibrium statistical mechanics
Statistical mechanics of solid state physics
Bose-Einstein condensates
Density matrices (for quantum mechanics with superpositions)
Polymer theory
Ising lattices, phase transitions
Information theory
Maxwell's demon / Brownian ratchet
Semiconductors
Percolation theory
The structure of liquid water
Crystals - heat capacity, lattice dynamics, phonons
Entropy of black holes
Thermodynamic limits to computation
Non-ideal gases
Phase transitions
Superconductivity, Landau-Ginzburg theory
Statistical mechanics of fluids
Heat death of the universe
Brownian motion

Something related to a project that you are already working on
A new project (let me know if you want suggestions)