# **Ising Model for Simulation of Magnetic Order**

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## **Principles of an Ising Model**

The Ising Model simulates an array of interacting electron spins and associated magnetic order. The model represents a spin state of up with the color blue, and spin state of down with red. Solid, continuous groups of the same color represent magnetic domains. The main principle behind the model is to capture the balance between the two driving forces of thermal energy, trying to induce disorder within the system, and interaction energy, trying to bring order to the system.

### **Computational Implementation**

In order to represent a semi-infinite system, we use periodic boundary conditions, so that the particles on the edge of the model are neighbors with particles on the opposite edge.



Algorithm:

- 1) Summing over interactions between neighbors to determine energy of the state
- 2) Energy of the state if it were to flip
- 3) Based on the change in energy, probability to flip is calculated with the formula exp(-deltaE/ k<sub>B</sub>T)
- 4) Generate a random number to determine if the flip is accepted

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#### Antiferromagnetic (J < 0)



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## **Ising Model Visualizations**

