Open positions for master thesis project:
Quantum simulations and many-body physics with spins in diamond

Taminiau Lab, QuTech

The physical implementation of a quantum simulator requires a controllable quantum mechanical system. Nuclear 13C spins associated to a single **nitrogen-vacancy** (NV) defect in diamond (depicted in Fig. 1) do not only provide promising qubits for quantum information processing [1] and quantum networks [2] but can also realise a **quantum simulator** [3]. Quantum simulators can explore new physical phenomena, that are hard to be simulated classically.

In the field of **many-body physics**, exotic quantum phases of matter have gotten a lot of attention. More specifically, the breaking of discrete time translation symmetry in periodically driven Floquet sequences which leads to a phase of matter called a **time crystal** [4].

For more information just chat with us or send us a message!

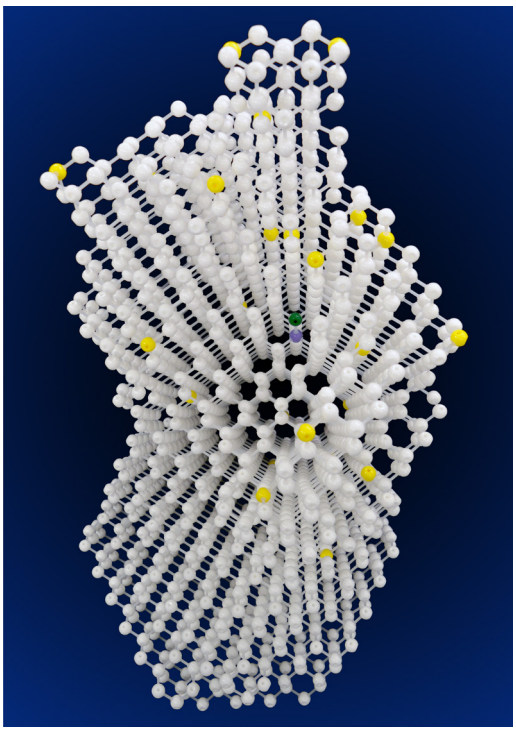

Fig.1 Three-dimensional image of 50-spin cluster model.

Project Directions

In the quantum-simulation team of the Taminiau lab, there are three possible ideas for projects . All of these provide a general direction but can be adjusted to your interest..

1. **Theoretical and experimental** investigation of response of many-body system under global driving (**3D time-crystal**).
2. Investigation of the **polarisation spread** throughout a many-body system under different conditions.
3. Develop **experimental method** for the measurement of entanglement entropy throughout the spin cluster.

Interested?

Contact: Christina Ioannou
or Kai-Niklas Schymik

[1] M. H. Abobeih et al " Nature, vol. 606, pp. 884–889, 2022.
[2] M. Pompili et al " Science, vol. 372, 259–264, 2021.
[3] J. Randall, Science, Nov. 2021.
[4] N. Y. Yao et al, Physics Today, vol. 71,, 40–47, 2018