Various phases of discrete time crystal in driven central spin model

Hillol Biswas [a], Sayan Choudhury [a]

[a] *Harish-Chandra Research Institute, Prayagraj, UP*

E-mail: (hillolbiswas@hri.res.in)

Abstract: We propose and characterize a driving protocol for an interacting central spin system to establish a perfect period doubling time crystal phase at certain values of interaction strength for any initial state and any system size. The nature of the time crystal depends on the odd-even parity of the number of satellite spins and the value of the central spin. Alongside the numerical simulation, we provide an analytical explanation for this behavior. Then we explore the sensing capability of this system to measure the interaction between the central spin and the satellite spins. The time crystal phase shows enhanced sensitivity as we see the Quantum Fisher Information scales as N^2 (N being the system size). Along with this, we find some period 4, period 12 and period 24 time crystal at some finely tuned values of interaction strength.