Schwinger boson mean-field theory for the Kitaev model in a [111]-magnetic field

T.Yzeiri,[1,2] S. Thiagarajan,[1] and F. Krüger[1,2]

[1]*London Centre for Nanotechnology,*
University College London, Gordon St.,
London, WC1H 0AH, United Kingdom
[2]*ISIS Facility, Rutherford Appleton Laboratory, Chilton,*
Didcot, Oxfordshire OX11 0QX, United Kingdom

We study the Kitaev model in a [111]-magnetic field using both Majorana fermion and Schwinger boson mean field theory approaches. The field opens a topological gap in both spectra and leads to a sequence of topological phase transitions when using Majorana fermions, before a field-polarised state is reached in both approaches. We show that SBMFT cannot initially capture a topological intermediate phase that appears when using Majorana fermions, and investigate this by including an additional Lagrange multiplier, which corresponds to a bond operator decoupling scheme commonly used in literature [1]. We then use Schwinger Bosons to analyse the behaviour of the magnetic excitation spectra and identify quantum spin liquid features near the topological phase transition that survive at finite temperatures.

References:

[1] X.Yang and F.Wang, Phys. Rev. B 94 035160 (2016)