

Project plan

Simulations of magnetic dipoles on a spherical surface

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1 Questions

- Vertex histogram
- Number of rotations per magnet
- Spin ice
- Nearest neighbour interaction only?
- Correlation between magnets
- How to normalise (correlation)?
- Should we read book : Introduction to Frustrated Magnetism
<http://www-thphys.physics.ox.ac.uk/talks/CMTjournalclub/sources/introFrustratedMagnetism.pdf>

2 Initial steps (3-4 weeks)

- Get acquainted with existing code. (v.hard?) ✓
- Acquaint Arjun with C++ code. (hard) ✓
- Convert grains to magnets:
 - Change interactions. (medium) ✓
 - Change shape from sphere to cylinder. (v.easy) ✓
- Draw cube. (medium) ✓
- Draw dodecahedron. (medium) ✓
- Add buttons. (hard):
 - A button allowing to type a number and select one of the magnets and then changing its attributes. ✓
 - An external force H slider button. ✓
 - A plot button. (if plotting using QT, else textual drawing and matlab)

- Add interactivity. (almost impossible but instead) **X**:
 - Buttons and sliders. ✓
 - UI elements such as time and Hamiltonian and correlation displayed as numbers.
- Enhance colours and textures of the graphics and GUI. (medium)
- Start working on the numerical schema. (v.hard)
- *Draw flux lines (v.v.hard) (**not** really important)*

3 Reading literature (4 weeks)

- Wills, A. S., Ballou, R. and Lacroix, C. Phys. Rev. B 66, 144407, (2002).
- Bramwell, S. T. and Gingras, M. J. P. Science 294, 1495-1501, (2001).
- Ladak, S., Read, D. E., Perkins, G. K., Cohen, L. F. et al. Nature Physics 6, 359-363, (2010).
- Textbook frustrated magnetism (Chapter 12, p321)

<http://www-thphys.physics.ox.ac.uk/talks/CMTjournalclub/sources/introFrustratedMagnetism.pdf>

- honeycomb lattice

<http://iopscience.iop.org/article/10.1088/1367-2630/14/3/035022/pdf>

- Verlet method

<http://physics.bu.edu/py502/lectures3/cmotion.pdf>

- Paula's paper

<https://link.aps.org/accepted/10.1103/PhysRevLett.109.257203>

- Paula's supplements

https://journals-aps-org.iclibezp1.cc.ic.ac.uk/prl/supplemental/10.1103/PhysRevLett.109.257203/Spin-ice-SI-nov_3.pdf

4 Experimenting with the schema and the configuration (1-2 weeks)

- Outputting data and analysing and plotting with Matlab:
 - Hamiltonian.
 - Flux.