EFM With Field in 111 Starting With Random and Ground Initial States

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Overview

The effective field method was used to 2000 iterations to determine the 0 temperature states of the 12x12x12 3D FCC kagome lattice while being subjected to a changing magnetic field along the 111 direction. The field was either incremented or decremented in steps of 0.0001. There were 4 cases studied:

- 1. Increasing magnetic field in the 111 direction from 0.00 to 0.05, with an initial spin configuration that was a ground state with theta = 0.206275 and phi = 3.11867.
- 2. **Increasing** magnetic field in the **111** direction from **0.00 to 0.05**, with an initial spin configuration that was **randomly generated**.
- 3. **Decreasing** magnetic field in the **111** direction from **0.05** to **0.00**, with an initial spin configuration that was a **ground state** with theta = 0.206275 and phi = 3.11867.
- 4. **Decreasing** magnetic field in the **111** direction from **0.05** to **0.00**, with an initial spin configuration that was randomly generated.

Analysis that was performed on the resulting data included the following:

- Plots of magnetization versus field
- Plots of energy versus field
- Animations of the characteristic 6 spins
- Animations of a subsection of the lattice
- Determination of the number of "unique" spins that populate the lattice
- Determination of the components of the unique spins
- Plots of azimuth and zenith angles of the A, B, C, spins w.r.t. the plane of the 111 normal vector

RUN 1: Increasing Field, Ground State

Steps persist in the energy graphs. This can probably be fixed by increasing precision. A sudden drop in energy occurs at field 0.006. This corresponds to the spin configuration snapping into a planar state, where the applied field vector intersects the plane. The angle of intersection is not perpendicular, but looks close to it. Once in the planar state, the spins gradually align with the field, and nothing else interesting happens.

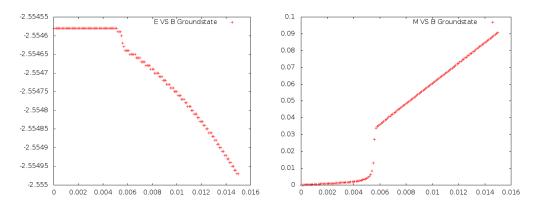


Figure 1: Energy vs increasing field and Magnetization versus increasing field

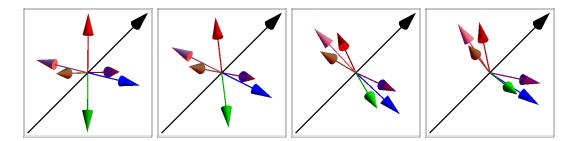


Figure 2: Snapshots of the 6 characteristic spins of the lattice at B=0, B=0.0052, B=0.0077, and B=0.05

6 0,0000 6 0,0050 6 0,0250	0.0499	ø	0.0449	σ	0.0399	σ	0.0349	o	0.0299	o	0.0249	o	0.0199	o	0.0149	o	0.0099	0.0049 6
County	0.0498	o	0.0448	თ	0.0398	თ	0.0348	o	0.0298	o	0.0248	თ	0.0198	o	0.0148	o	0.0098	
200055 200055 200070	0.0497	o	0.0447	o	0.0397	o	0.0347	o	0.0297	o	0.0247	o	0.0197	o	0.0147	o	0.0097	
No. 00050 6 0.0070 6 0.0750 6 0.0250	0.0496	o	0.0446	o	0.0396	o	0.0346	o	0.0296	o	0.0246	o	0.0196	o	0.0146	o	0.0096	0.0046 6
20.0055 20.0050 6 0.0070 6 0.0075 6 0.0270	0.0495	o	0.0445	თ	0.0395	o	0.0345	o	0.0295	o	0.0245	o	0.0195	o	0.0145	o	0.0095	0.0045 7
No. 000500 6 0.00700 6 0.00750 6 0.00250 6 0	0.0494	o	0.0444	o	0.0394	o	0.0344	o	0.0294	o	0.0244	o	0.0194	o	0.0144	o	0.0094	
Sudden	0.0493	o	0.0443	o	0.0393	o	0.0343	o	0.0293	o	0.0243	σ	0.0193	o	0.0143	o	0.0093	
2.00050 2.00050 2.00000 2.00050 2.	0.0492	o	0.0442	o	0.0392	o	0.0342	o	0.0292	o	0.0242	o	0.0192	o	0.0142	o	0.0092	
6 0.00501 6 0.00001 6 0.00501 6 0.00501 6 0.00501 6 0.00501 6 0.00501 6 0.00501 6 0.00501 6 0.00501 6 0.00502 6 0.00502 6 0.00502 6 0.00502 6 0.00402 <t< td=""><td>0.0491</td><td>o</td><td>0.0441</td><td>o</td><td>0.0391</td><td>o</td><td>0.0341</td><td>o</td><td>0.0291</td><td>o</td><td>0.0241</td><td>o</td><td>0.0191</td><td>o</td><td>0.0141</td><td>o</td><td>0.0091</td><td></td></t<>	0.0491	o	0.0441	o	0.0391	o	0.0341	o	0.0291	o	0.0241	o	0.0191	o	0.0141	o	0.0091	
Coloridad Col	0.0490	o	0.0440	o	0.0390	σ	0.0340	o	0.0290	o	0.0240	o	0.0190	o	0.0140	o	0.0090	
6 0.00000 6 0.00750 6 0.00750 6 0.00750 6 0.00750 6 0.00750 6 0.00750 6 0.0050 6 0.0050 6 0.0050 6 0.0050 6 0.0050 6 0.0050 6 0.0050 6 0.0050 6 0.0050 6 0.0040	0.0489	o	0.0439	o	0.0389	o	0.0339	o	0.0289	o	0.0239	o	0.0189	o	0.0139	o	0.0089	
6 0.00000 6 0.00700 6 0.00700 6 0.00700 6 0.00700 6 0.00700 6 0.00700 6 0.00200 <t< td=""><td>0.0488</td><td>o</td><td>0.0438</td><td>o</td><td>0.0388</td><td>o</td><td>0.0338</td><td>o</td><td>0.0288</td><td>o</td><td>0.0238</td><td>o</td><td>0.0188</td><td>o</td><td>0.0138</td><td>o</td><td>0.0088</td><td></td></t<>	0.0488	o	0.0438	o	0.0388	o	0.0338	o	0.0288	o	0.0238	o	0.0188	o	0.0138	o	0.0088	
6 0.000000 6 0.000000 6 0.000000 6 0.000000 6 0.000000 6 0.00000 6 0.000000 6 0.000000 6 0.000000 6 0.00000 6 0.00000000 6 0.0000000 <	0.0487	o	0.0437	o	0.0387	o	0.0337	o	0.0287	o	0.0237	o	0.0187	o	0.0137	o	0.0087	
6 0.00001 6 0.01001 6 0.01001 6 0.01001 6 0.01001 6 0.01001 6 0.02001 6 0.02001 6 0.02001 6 0.02001 6 0.02001 6 0.02001 6 0.02001 6 0.02001 6 0.02001 6 0.04012 6 0.04012 6 0.04012 6 0.04012 6 0.04012 6 0.04012 6 0.04012 6 0.04012 6 0.04013 6 0.04013 6 0.04013 6 0.04013 6 0.04013 6 0.04013 6 0.04013 6 0.04013 6 0.04013 6 0.04013 6 0.04013 6 0.04013 6 0.04013 6 0.04013 6 0.04013 6 0.02014 6 0.02014 6 0.02014 6 0.02014 6 0.02014 6 0.02014 6 0.02014 6 0.02014 <t< td=""><td>0.0486</td><td>o</td><td>0.0436</td><td>o</td><td>0.0386</td><td>o</td><td>0.0336</td><td>o</td><td>0.0286</td><td>o</td><td>0.0236</td><td>o</td><td>0.0186</td><td>o</td><td>0.0136</td><td>o</td><td>0.0086</td><td></td></t<>	0.0486	o	0.0436	o	0.0386	o	0.0336	o	0.0286	o	0.0236	o	0.0186	o	0.0136	o	0.0086	
6 0.00050 6 0.00100 6 0.00170 6 0.00170 6 0.00270 6 0.0200 6 0.0200 6 0.0200 6 0.0250 6 0.0250 6 0.0250 6 0.0250 6 0.0252 6 0.0252 6 0.0252 6 0.0252 6 0.0262 6 0.0402 6 6 0.00052 6 0.0007 6 0.0025 6 0.0025 6 0.0243 6 0.0025 6 0.0040 6	0.0485	o	0.0435	o	0.0385	o	0.0335	o	0.0285	o	0.0235	o	0.0185	o	0.0135	o	0.0085	
6 0.00050 6 0.00100 6 0.00170 6 0.00170 6 0.00170 6 0.00170 6 0.00200 6 0.0200	0.0484	o	0.0434	o	0.0384	σ	0.0334	o	0.0284	o	0.0234	o	0.0184	o	0.0134	o	0.0084	
6 0.00050 6 0.00050 6 0.00050 6 0.00050 6 0.00050 6 0.00050 6 0.00050 6 0.00050 6 0.00050 6 0.00050 6 0.00050 6 0.00050 6 0.00050 6 0.00050 6 0.00050 6 0.00050 6 0.00402 6 0.00402 6 0.00403 <th< td=""><td>0.0483</td><td>o</td><td>0.0433</td><td>o</td><td>0.0383</td><td>σ</td><td>0.0333</td><td>o</td><td>0.0283</td><td>o</td><td>0.0233</td><td>o</td><td>0.0183</td><td>o</td><td>0.0133</td><td>o</td><td>0.0083</td><td></td></th<>	0.0483	o	0.0433	o	0.0383	σ	0.0333	o	0.0283	o	0.0233	o	0.0183	o	0.0133	o	0.0083	
6 0.00050 6 0.00050 6 0.00100 6 0.00150 6 0.00150 6 0.00250 6 0.00250 6 0.00250 6 0.00250 6 0.00250 6 0.00300 6 0.00301 6 0.00401 6 6 0.00052 6 0.00102 6 0.00402 6 <td>0.0482</td> <td>o</td> <td>0.0432</td> <td>თ</td> <td>0.0382</td> <td>o</td> <td>0.0332</td> <td>o</td> <td>0.0282</td> <td>o</td> <td>0.0232</td> <td>o</td> <td>0.0182</td> <td>o</td> <td>0.0132</td> <td>o</td> <td>0.0082</td> <td></td>	0.0482	o	0.0432	თ	0.0382	o	0.0332	o	0.0282	o	0.0232	o	0.0182	o	0.0132	o	0.0082	
6 0.00050 6 0.00050 6 0.00050 6 0.00050 6 0.00050 6 0.00400 <th< td=""><td>0.0481</td><td>o</td><td>0.0431</td><td>o</td><td>0.0381</td><td>σ</td><td>0.0331</td><td>o</td><td>0.0281</td><td>o</td><td>0.0231</td><td>o</td><td>0.0181</td><td>o</td><td>0.0131</td><td>o</td><td>0.0081</td><td></td></th<>	0.0481	o	0.0431	o	0.0381	σ	0.0331	o	0.0281	o	0.0231	o	0.0181	o	0.0131	o	0.0081	
6 0.00000 6 0.00700 6 0.00700 6 0.00700 6 0.00700 6 0.00700 6 0.00400 <th< td=""><td>0.0480</td><td>o</td><td>0.0430</td><td>o</td><td>0.0380</td><td>σ</td><td>0.0330</td><td>o</td><td>0.0280</td><td>o</td><td>0.0230</td><td>o</td><td>0.0180</td><td>o</td><td>0.0130</td><td>o</td><td>0.0080</td><td></td></th<>	0.0480	o	0.0430	o	0.0380	σ	0.0330	o	0.0280	o	0.0230	o	0.0180	o	0.0130	o	0.0080	
6 0.00050 6 0.0150 6 0.0150 6 0.0150 6 0.0150 6 0.0201 6 0.0250 6 0.0251 6 0.0251 6 0.0251 6 0.0251 6 0.0251 6 0.0251 6 0.0251 6 0.0251 6 0.0401 6 6 0.0052 6 0.0102 6 0.0152 6 0.0402 6 0.0402 6 6 0.0052 6 0.0103 6 0.0153 6 0.0253 6 0.0253 6 0.0404 6 6 0.0052 6 0.0103 6 0.0253 6 0.0253 6 0.0240 6 0.0254 6 0.0253 6 0.0403 6 0.0403 6 0.0254 6 0.0254 6 0.0254 6 0.0254 6 0.0254 6 0.0254 6 0.0254 6 0.0254 6 <	0.0479	o	0.0429	o	0.0379	o	0.0329	o	0.0279	o	0.0229	o	0.0179	o	0.0129	o	0.0079	
6 0.0050 6 0.0050 6 0.0050 6 0.0050 6 0.0400 6 0.0250 6 0.0250 6 0.0250 6 0.0251 6 0.0251 6 0.0251 6 0.0252 6 0.0352 6 0.0400 6 6 0.0052 6 0.0402 6 0.0452 6 0.0402 6 0.0402 6 6 0.0053 6 0.0753 6 0.0253 6 0.0253 6 0.0402 6 6 0.0053 6 0.0753 6 0.0253 6 0.0253 6 0.0403 6 0.0403 6 6 0.0053 6 0.0753 6 0.0253 6 0.0253 6 0.0253 6 0.0403 6 0.0403 6 0.0403 6 0.0403 6 0.0403 6 0.0403 6 0.0253 6 0.0253 6 0.0	0.0478	o	0.0428	o	0.0378	o	0.0328	o	0.0278	o	0.0228	o	0.0178	o	0.0128	o	0.0078	
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6 0.0050 6 0.0070 6 0.0170 6 0.0201 6 0.0201 6 0.0201 6 0.0201 6 0.0201 6 0.0201 6 0.0301 6 0.0351 6 0.0401 6 0.0401 6 0.0401 6 0.0401 6 0.0401 6 0.0401 6 0.0402 6 0.0402 6 0.0402 6 0.0402 6 0.0403 6<	0.0476	o	0.0426	o	0.0376	o	0.0326	o	0.0276	o	0.0226	o	0.0176	o	0.0126	o	0.0076	
6 0.0050 6 0.0100 6 0.00750 6 0.0170 6 0.0170 6 0.0170 6 0.0270 6 0.0250 6 0.0251 6 0.0240 6 0.0251 6 0.0240 6 0.0251 6 0.0240 6 0.0240 6 0.0401 6 6 0.0052 6 0.0102 6 0.0252 6 0.0243 6 0.0243 6 0.0243 6 0.0243 6 0.0243 6 0.0244 6 0.0403 6 0.0403 6 0.0403 6 0.0403 6 0.0403 6 0.0404 6 0.0254 6 0.0254 6 0.0254 6 0.0254 6 0.0254 6 0.0254 6 0.0254 6 0.0254 6 0.0254 6 0.0254 6 0.0254 6 0.0254 6 0.0254 6 0.0254 6 0.0254 6	0.0475	o	0.0425	თ	0.0375	თ	0.0325	o	0.0275	o	0.0225	თ	0.0175	o	0.0125	o	0.0075	
6 0.0050 6 0.01701 6 0.01751 6 0.01701 6 0.0271 6 0.0271 6 0.02701 6 0.02701 6 0.02701 6 0.0251 6 0.0301 6 0.0351 6 0.0401 6 6 0.0052 6 0.0103 6 0.01753 6 0.0252 6 0.0302 6 0.0401 6 6 0.0052 6 0.0103 6 0.0253 6 0.0303 6 0.0404 6 6 0.0053 6 0.0103 6 0.0253 6 0.0303 6 0.0353 6 0.0404 6 6 0.0054 6 0.0105 6 0.0256 6 0.0307 6 0.0353 6 0.0406 6 6 0.0057 6 0.0175 6 0.0260 6 0.0257 6 0.0307 6 0.0406 6 0	0.0474	o	0.0424	σ	0.0374	σ	0.0324	o	0.0274	o	0.0224	o	0.0174	o	0.0124	o	0.0074	
6 0.0050 6 0.0010 6 0.0150 6 0.0150 6 0.0250 6 0.0250 6 0.0251 6 0.0251 6 0.0251 6 0.0351 6 0.0401 6 6 0.0052 6 0.0012 6 0.0252 6 0.0351 6 0.0401 6 6 0.0052 6 0.0102 6 0.0252 6 0.0352 6 0.0402 6 6 0.0053 6 0.0103 6 0.0253 6 0.0333 6 0.0403 6 6 0.0054 6 0.0153 6 0.0203 6 0.0354 6 0.0405 6 6 0.0055 6 0.0106 6 0.0153 6 0.0207 6 0.0257 6 0.0359 6 0.0405 6 7 0.0057 6 0.0153 6 0.0207 6 0.0253	0.0473	o	0.0423	o	0.0373	o	0.0323	o	0.0273	o	0.0223	o	0.0173	o	0.0123	o	0.0073	
6 0.0050 6 0.0100 6 0.0050 6 0.0200 6 0.0251 6 0.0251 6 0.0251 6 0.0251 6 0.0351 6 0.0400 6 6 0.0052 6 0.0102 6 0.0252 6 0.0352 6 0.0402 6 6 0.0052 6 0.0102 6 0.0252 6 0.0352 6 0.0402 6 6 0.0053 6 0.0103 6 0.0253 6 0.0352 6 0.0403 6 6 0.0054 6 0.0154 6 0.0255 6 0.0253 6 0.0352 6 0.0403 6 6 0.0055 6 0.0105 6 0.0256 6 0.0256 6 0.0355 6 0.0406 6 6 0.0057 6 0.0256 6 0.0256 6 0.0356 6 0.0406	0.0472	o	0.0422	თ	0.0372	თ	0.0322	o	0.0272	o	0.0222	თ	0.0172	o	0.0122	o	0.0072	
6 0.0050 6 0.0100 6 0.0170 6 0.0250 6 0.0251 6 0.0251 6 0.0251 6 0.0251 6 0.0351 6 0.0400 6 0.0400 6 0.0400 6 0.0400 6 0.0400 6 0.0400 6 0.0400 6 0.0400 6 0.0400 6 0.0400 6 0.0402 6 0.0402 6 0.0402 6 0.0402 6 0.0402 6 0.0403 6<	0.0471	o	0.0421	σ	0.0371	σ	0.0321	o	0.0271	o	0.0221	o	0.0171	o	0.0121	o	0.0071	
6 0.0050 6 0.0100 6 0.0050 6 0.01701 6 0.0051 6 0.0251 6 0.0251 6 0.0251 6 0.0251 6 0.0251 6 0.0251 6 0.0251 6 0.0251 6 0.0251 6 0.0251 6 0.0251 6 0.0401 6 0.0402 6 6 0.0052 6 0.0103 6 0.0153 6 0.0253 6 0.0353 6 0.0403 6 6 0.0053 6 0.0103 6 0.0253 6 0.0253 6 0.0403 6 6 0.0053 6 0.0103 6 0.0253 6 0.0253 6 0.0353 6 0.0403 6 6 0.0054 6 0.0103 6 0.0253 6 0.0253 6 0.0353 6 0.0403 6 0.0403 6 0.0403 6 0.	0.0470	o	0.0420	o	0.0370	თ	0.0320	o	0.0270	o	0.0220	o	0.0170	o	0.0120	o	0.0070	
6 0.0050 6 0.0100 6 0.0150 6 0.0201 6 0.0251 6 0.0251 6 0.0251 6 0.0251 6 0.0251 6 0.0251 6 0.0251 6 0.0251 6 0.0351 6 0.0401 6 6 0.0052 6 0.0152 6 0.0252 6 0.0351 6 0.0402 6 6 0.0053 6 0.0153 6 0.0203 6 0.0333 6 0.0403 6 6 0.0054 6 0.0103 6 0.0254 6 0.0303 6 0.0353 6 0.0403 6 6 0.0054 6 0.0103 6 0.0254 6 0.0354 6 0.0403 6 0.0403 6 0.0403 6 0.0403 6 0.0403 6 0.0354 6 0.0403 6 0.0354 6 0.0403 6 0.0	0.0469	თ	0.0419	თ	0.0369	თ	0.0319	o	0.0269	o	0.0219	თ	0.0169	o	0.0119	o	0.0069	
6 0.0050 6 0.0100 6 0.0150 6 0.0201 6 0.0201 6 0.0251 6 0.0251 6 0.0251 6 0.0251 6 0.0251 6 0.0251 6 0.0251 6 0.0351 6 0.0401 6 6 0.0052 6 0.0152 6 0.0223 6 0.0231 6 0.0402 6 6 0.0053 6 0.0153 6 0.0223 6 0.0333 6 0.0403 6 6 0.0054 6 0.0154 6 0.0204 6 0.0254 6 0.0353 6 0.0403 6 6 0.0055 6 0.0255 6 0.0204 6 0.0354 6 0.0403 6 0.0403 6 0.0403 6 0.0403 6 0.0403 6 0.0403 6 0.0403 6 0.0403 6 0.0403 6 0.0	0.0468	o	0.0418	o	0.0368	o	0.0318	o	0.0268	o	0.0218	o	0.0168	o	0.0118	7	0.0068	
6 0.0050 6 0.0170 6 0.0250 6 0.0250 6 0.0251 6 0.0350 6 0.0350 6 0.0401 6 0.0401 6 0.0401 6 0.0401 6 0.0401 6 0.0401 6 0.0401 6 0.0401 6 0.0401 6 0.0401 6 0.0401 6 0.0401 6 0.0401 6 0.0402 6 0.0253 6 0.0352 6 0.0403 6 0.0404 6<	0.0467	o	0.0417	o	0.0367	o	0.0317	o	0.0267	o	0.0217	o	0.0167	o	0.0117	o	0.0067	
6 0.0050 6 0.0100 6 0.0150 6 0.0200 6 0.0251 6 0.0350 6 0.0401 6 0.0401 6 0.0401 6 0.0401 6 0.0401 6 0.0401 6 0.0401 6 0.0401 6 0.0401 6 0.0401 6 0.0401 6 0.0401 6 0.0402 6 0.0402 6 0.0402 6 0.0402 6 0.0402 6 0.0402 6 0.0402 6 0.0402 6 0.0402 6 0.0402 6 0.0402 6 0.0402 6 0.0402 6 0.0403 6 0.0403 6 0.0403 6 0.0403 6 0.0403 6 0.0403 6 0.0403 6 0.0403 6 0.0403 6 0.0403 6 0.0403 6 0.0403 6 0.0403 6 0.0403 6 0.0403 6 0.0403 6<	0.0466	o	0.0416	o	0.0366	o	0.0316	o	0.0266	o	0.0216	o	0.0166	o	0.0116	o	0.0066	
6 0.0050 6 0.0100 6 0.0150 6 0.0200 6 0.0251 6 0.0350 6 0.0350 6 0.0401 6 0.0401 6 0.0401 6 0.0401 6 0.0401 6 0.0401 6 0.0401 6 0.0401 6 0.0401 6 0.0401 6 0.0401 6 0.0401 6 0.0402 6 0.0402 6 0.0402 6 0.0402 6 0.0402 6 0.0402 6 0.0402 6 0.0402 6 0.0402 6 0.0402 6 0.0402 6 0.0402 6 0.0402 6 0.0402 6 0.0402 6 0.0403 6 0.0403 6 0.0403 6 0.0403 6 0.0403 6 0.0404 6 0.0404 6 0.0403 6 0.0254 6 0.0355 6 0.0403 6 0.0403 6 0.0403 6<	0.0465	o	0.0415	o	0.0365	o	0.0315	o	0.0265	o	0.0215	o	0.0165	o	0.0115	-7	0.0065	
6 0.0050 6 0.0100 6 0.0150 6 0.0200 6 0.0250 6 0.0350 6 0.0350 6 0.0401 6 6 0.0057 6 0.0157 6 0.0251 6 0.0251 6 0.0351 6 0.0401 6 6 0.0052 6 0.0152 6 0.0251 6 0.0252 6 0.0351 6 0.0407 6 6 0.0052 6 0.0103 6 0.0253 6 0.0333 6 0.0352 6 0.0402 6 6 0.0054 6 0.0154 6 0.0203 6 0.0354 6 0.0403 6 0.0403 6 0.0354 6 0.0403 6 0.0403 6 0.0403 6 0.0403 6 0.0403 6 0.0403 6 0.0403 6 0.0403 6 0.0403 6 0.0403 6 0.0	0.0464	o	0.0414	o	0.0364	0	0.0314	o	0.0264	o	0.0214	o	0.0164	o	0.0114	o	0.0064	
6 0.0050 6 0.0100 6 0.0150 6 0.0200 6 0.0251 6 0.0350 6 0.0350 6 0.0400 6 6 0.0051 6 0.0151 6 0.0251 6 0.0251 6 0.0351 6 0.0401 6 6 0.0052 6 0.0152 6 0.0251 6 0.0251 6 0.0351 6 0.0402 6 6 0.0053 6 0.0152 6 0.0203 6 0.0353 6 0.0403 6 6 0.0053 6 0.0154 6 0.0203 6 0.0354 6 0.0403 6 6 0.0054 6 0.0154 6 0.0204 6 0.0354 6 0.0403 6 0.0403 6 0.0403 6 0.0403 6 0.0403 6 0.0403 6 0.0403 6 0.0354 6 0.0404 </td <td>0.0463</td> <td>o</td> <td>0.0413</td> <td>o</td> <td>0.0363</td> <td>o</td> <td>0.0313</td> <td>o</td> <td>0.0263</td> <td>o</td> <td>0.0213</td> <td>o</td> <td>0.0163</td> <td>o</td> <td>0.0113</td> <td>o</td> <td>0.0063</td> <td></td>	0.0463	o	0.0413	o	0.0363	o	0.0313	o	0.0263	o	0.0213	o	0.0163	o	0.0113	o	0.0063	
6 0.0050 6 0.0100 6 0.0150 6 0.0200 6 0.0250 6 0.0350 6 0.0400 6 6 0.0051 6 0.0251 6 0.0251 6 0.0251 6 0.0351 6 0.0401 6 6 0.0052 6 0.0152 6 0.0251 6 0.0252 6 0.0252 6 0.0351 6 0.0402 6 6 0.0052 6 0.0103 6 0.0153 6 0.0203 6 0.0252 6 0.0303 6 0.0402 6 6 0.0053 6 0.0103 6 0.0253 6 0.0203 6 0.0353 6 0.0403 6 6 0.0054 6 0.0155 6 0.0205 6 0.0255 6 0.0355 6 0.0405 6 6 0.0055 6 0.0156 6 0.0206	0.0462	o	0.0412	o	0.0362	o	0.0312	o	0.0262	o	0.0212	o	0.0162	o	0.0112	o	0.0062	
6 0.0050 6 0.0100 6 0.0150 6 0.0200 6 0.0250 6 0.0350 6 0.0400 6 6 0.0051 6 0.01751 6 0.0251 6 0.0251 6 0.0251 6 0.0350 6 0.0401 6 6 0.0052 6 0.0152 6 0.0251 6 0.0252 6 0.0252 6 0.0303 6 0.0402 6 6 0.0052 6 0.0153 6 0.0253 6 0.0252 6 0.0303 6 0.0402 6 6 0.0054 6 0.0153 6 0.0203 6 0.0233 6 0.0353 6 0.0403 6 6 0.0054 6 0.0154 6 0.0205 6 0.0255 6 0.0303 6 0.0353 6 0.0403 6 6 0.0055 6 0.0166	0.0461	o	0.0411	o	0.0361	o	0.0311	o	0.0261	o	0.0211	o	0.0161	o	0.0111	o	0.0061	
6 0.0050 6 0.0100 6 0.0150 6 0.0200 6 0.0250 6 0.0350 6 0.0400 6 6 0.0051 6 0.01751 6 0.0251 6 0.0251 6 0.0351 6 0.0401 6 6 0.0052 6 0.0152 6 0.0251 6 0.0252 6 0.0252 6 0.0351 6 0.0402 6 6 0.0052 6 0.0153 6 0.0253 6 0.0252 6 0.0252 6 0.0402 6 6 0.0053 6 0.0153 6 0.0203 6 0.0253 6 0.0353 6 0.0403 6 6 0.0054 6 0.0154 6 0.0204 6 0.0254 6 0.0354 6 0.0403 6 0.0403 6 0.0403 6 0.0403 6 0.0404 6 0.0405<	0.0460	o	0.0410	o	0.0360	o	0.0310	o	0.0260	o	0.0210	o	0.0160	o	0.0110	~	0.0060	
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6 0.0050 6 0.0100 6 0.0150 6 0.0200 6 0.0250 6 0.0300 6 0.0400 6 6 0.0051 6 0.0251 6 0.0251 6 0.0301 6 0.0401 6 6 0.0052 6 0.0102 6 0.0201 6 0.0251 6 0.0301 6 0.0401 6 6 0.0052 6 0.0102 6 0.0202 6 0.0252 6 0.0302 6 0.0402 6 6 0.0053 6 0.0103 6 0.0203 6 0.0253 6 0.0303 6 0.0403 6 6 0.0054 6 0.0204 6 0.0253 6 0.0305 6 0.0403 6 6 0.0058 6 0.0154 6 0.0204 6 0.0255 6 0.0305 6 0.0405 6 0.0405	0.0458	o	0.0408	o	0.0358	o	0.0308	o	0.0258	o	0.0208	o	0.0158	o	0.0108	o	0.0058	
6 0.0050 6 0.0100 6 0.0200 6 0.0250 6 0.0300 6 0.0350 6 0.0400 6 6 0.0051 6 0.01751 6 0.0201 6 0.0251 6 0.0351 6 0.0401 6 6 0.0052 6 0.01752 6 0.0201 6 0.0252 6 0.0302 6 0.0402 6 6 0.0053 6 0.0153 6 0.0203 6 0.0253 6 0.0353 6 0.0402 6 6 0.0054 6 0.0203 6 0.0253 6 0.0303 6 0.0403 6 6 0.0054 6 0.0204 6 0.0253 6 0.0304 6 0.0403 6 6 0.0055 6 0.0154 6 0.0204 6 0.0255 6 0.0305 6 0.0355 6 0.0405	0.0457	o	0.0407	o	0.0357	o	0.0307	o	0.0257	o	0.0207	o	0.0157	o	0.0107	o	0.0057	
6 0.0050 6 0.0150 6 0.0201 6 0.0250 6 0.0350 6 0.0401 6 6 0.0051 6 0.0101 6 0.0251 6 0.0251 6 0.0251 6 0.0251 6 0.0251 6 0.0251 6 0.0251 6 0.0251 6 0.0251 6 0.0252 6 0.0252 6 0.0252 6 0.0252 6 0.0252 6 0.0253 6 0.0253 6 0.0253 6 0.0253 6 0.0253 6 0.0253 6 0.0253 6 0.0254 6 0.0254 6 0.0254 6 0.0254 6 0.0254 6 0.0254 6 0.0354 6 0.0403 6 0.0403 6 0.0403 6 0.0405 6 0.0405 6 0.0405 6 0.0405 6 0.0405 6 0.0405 6 0.0405 6	0.0456	o	0.0406	თ	0.0356	თ	0.0306	o	0.0256	o	0.0206	თ	0.0156	o	0.0106	28	0.0056	
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6 0.0050 6 0.0100 6 0.0150 6 0.0200 6 0.0250 6 0.0300 6 0.0350 6 0.0400 6 6 0.0051 6 0.0051 6 0.0101 6 0.0151 6 0.0201 6 0.0251 6 0.0301 6 0.0351 6 0.0401 6 6 0.0052 6 0.0102 6 0.0152 6 0.0202 6 0.0252 6 0.0302 6 0.0352 6 0.0402 6	0.0453	o	0.0403	o	0.0353	o	0.0303	o	0.0253	o	0.0203	o	0.0153	o	0.0103	o	0.0053	
6 0.0050 6 0.0100 6 0.0150 6 0.0200 6 0.0250 6 0.0300 6 0.0350 6 0.0400 6 6 0.0051 6 0.0101 6 0.0151 6 0.0201 6 0.0251 6 0.0301 6 0.0351 6 0.0401 6	0.0452	o	0.0402	o	0.0352	o	0.0302	o	0.0252	o	0.0202	o	0.0152	o	0.0102	o	0.0052	
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	0.0450	o	0.0400	o	0.0350	o	0.0300	o	0.0250	o	0.0200	o	0.0150	o	0.0100	o	0.0050	0.0000 6

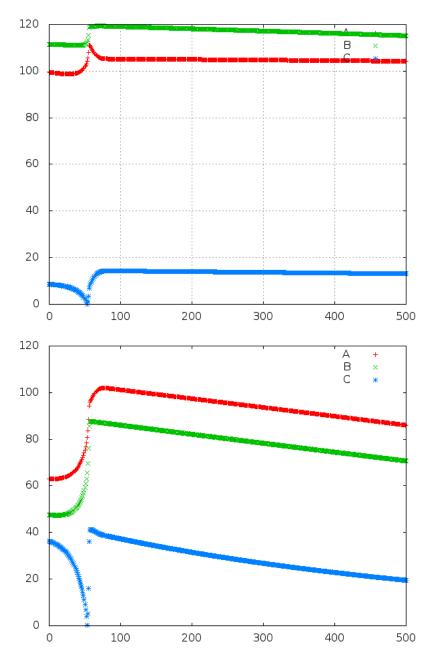


Figure 3: The angles are those between a chosen vector lying in the plane intersected by 111, and a projection of each of the A, B, and C spins. Azimuthal angles are followed by zenith angles.

RUN 2: Decreasing Field, Ground State

Steps persist in the energy graphs. Increasing precision can probably fix this. Unlike the case where the field was increased, a sudden transition does not occur within the spin configuration when decreasing the field. The field is initially at its highest, and the spins are partially aligned with the field. As the field is lowered, the spins gradually relax to a planar state, and do not return to the ground state that is typically observed at near zero or zero field.

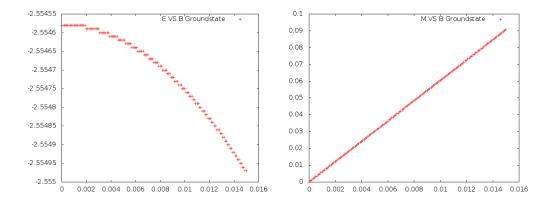


Figure 4: Energy vs decreasing field and Magnetization versus decreasing field

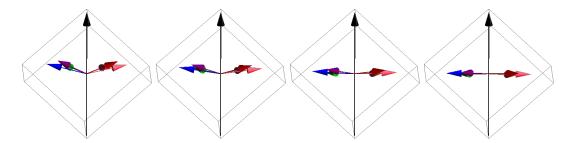


Figure 5: Snapshots of the 6 characteristic spins of the lattice at B=0.05, B=0.0309, B=0.01, and B=0.00

0.0321 0.0320 0.0319 0.0318 0.0316 0.0316 0.0314 0.0314 0.0313 0.0313 0.0317 0.0317 0.0310 0.0310 0.0310	, , , , , , , , , , , , , , , , , , ,	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	6 0.0271 6 6 0.0270 6 6 0.0269 6 6 0.0268 6 6 0.0266 6 6 0.0265 6 6 0.0263 6 6 0.0261 6 6 0.0259 6 6 0.0259 6 6 0.0259 6 6 0.0259 6 6 0.0259 6	6 0.0270 6 6 0.0263 6 6 0.0268 6 6 0.0266 6 6 0.0265 6 6 0.0263 6 6 0.0262 6 6 0.0262 6 6 0.0259 6 6 0.0259 6 6 0.0259 6 6 0.0258 6 6 0.0258 6 6 0.0258 6	6 0.0268 6 6 0.0268 6 6 0.0268 6 6 0.0265 6 6 0.0264 6 6 0.0262 6 6 0.0261 6 6 0.0259 6 6 0.0259 6 6 0.0259 6 6 0.0256 6	6 0.0268 6 6 0.0268 6 6 0.0268 6 6 0.0265 6 6 0.0264 6 6 0.0263 6 6 0.0261 6 6 0.0259 6 6 0.0259 6 6 0.0259 6 6 0.0259 6 6 0.0258 6	6 0.0263 6 0.0218 6 0.0268 6 0.0218 6 0.0268 6 0.0218 6 0.0266 6 0.0216 6 0.0265 6 0.0214 6 0.0265 6 0.0214 6 0.0262 6 0.0211 6 0.0263 6 0.0211 6 0.0263 6 0.0211 6 0.0253 6 0.0210 6 0.0259 6 0.0209 6 0.0259 6 0.0209 6 0.0259 6 0.0209 6 0.0259 6 0.0209 6 0.0259 6 0.0209 6 0.0259 6 0.0209 6 0.0258 6 0.0209 6 0.0258 6 0.0209 6 0.0258 6 0.0209	6 0.0269 6 0.0219 6 0.0218 6 0.0268 6 0.0218 6 0.02218 6 0.02217 6 0.02268 6 0.02215 6 0.02265 6 0.02214 6 0.0262 6 0.02213 6 0.0262 6 0.02213 6 0.0262 6 0.02213 6 0.0262 6 0.02213 6 0.0259 6
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				0.0278 6 0.0277 6 0.0276 6 0.0275 6 0.0274 6	0.0276 6 0.0275 6 0.0274 6	0.0275 6	0.0275 6 0.0274 6	0.0274 6 0.0224	0.0274 6 0.0224 6
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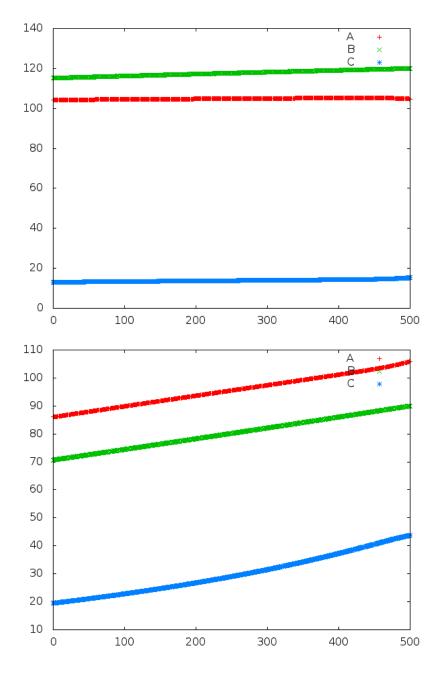


Figure 6: The angles are those between a chosen vector lying in the plane intersected by 111, and a projection of each of the A, B, and C spins. Azimuthal angles are followed by zenith angles.

RUN 3: Increasing Field, Random State

Very similar to run 1, where the lattice starts off at a ground state configuration and snaps into a planar configuration, followed by gradual alignment with the field. Note: the first data point in the energy and magnetization plots were removed since it was much higher than any other points on the graph, which caused the plot to become flattened in order to fit the entire range of data onto the same plot. This is likely due to the fact that 2000 iterations is insufficient for the energy to be minimized, and so starting from a random initial configuration causes the energy of the lattice at the first field value (B=0) to be much higher than the ground state since it has yet to become a ground state.

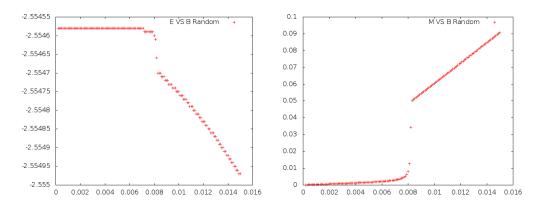


Figure 7: Energy vs increasing field and Magnetization versus increasing field

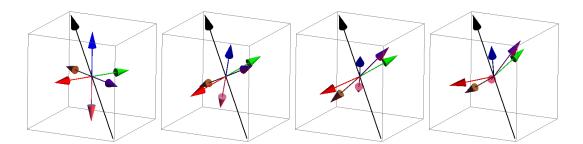


Figure 8: Snapshots of the 6 characteristic spins of the lattice

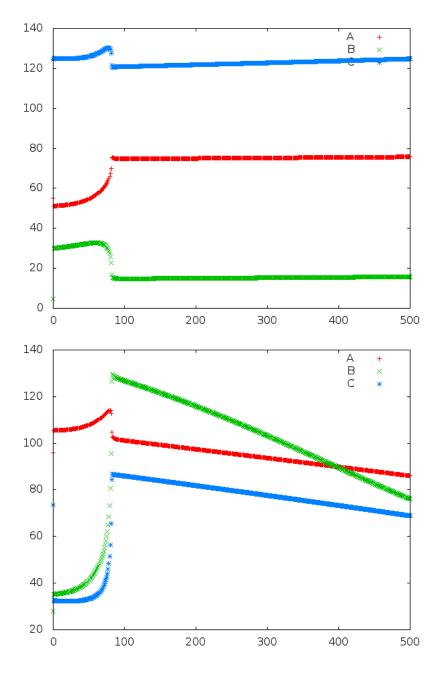


Figure 9: The angles are those between a chosen vector lying in the plane intersected by 111, and a projection of each of the A, B, and C spins. Azimuthal angles are followed by zenith angles.

o	0.0499	o	0.0449	o	0.0399	o	0.0349	o	0.0299	o	0.0249	o	0.0199	on	0.0149	o	0.0099	o	0.0049
o	0.0498		0.0448	o	0.0398	o	0.0348	o	0.0298	o	0.0248	o	0.0198	o	0.0148	o	0.0098	o	0.0048
o	0.0497		0.0447	o	0.0397	o	0.0347	o	0.0297	o	0.0247	o	0.0197	o	0.0147	o	0.0097	7	0.0047
o	0.0496		0.0446	o	0.0396	o	0.0346	o	0.0296	o	0.0246	o	0.0196	o	0.0146	o	0.0096	7	0.0046
o	0.0495		0.0445	o	0.0395	o	0.0345	o	0.0295	o	0.0245	o	0.0195	o	0.0145	o	0.0095	o	0.0045
o	0.0494		0.0444	o	0.0394	o	0.0344	o	0.0294	o	0.0244	o	0.0194	o	0.0144	o	0.0094	o	0.0044
o	0.0493		0.0443	o	0.0393	o	0.0343	o	0.0293	o	0.0243	o	0.0193	o	0.0143	o	0.0093	7	0.0043
o	0.0492		0.0442	o	0.0392	o	0.0342	o	0.0292	o	0.0242	o	0.0192	o	0.0142	o	0.0092	o	0.0042
o	0.0491		0.0441	o	0.0391	o	0.0341	o	0.0291	o	0.0241	o	0.0191	o	0.0141	o	0.0091	o	0.0041
o	0.0490		0.0440	o	0.0390	o	0.0340	o	0.0290	o	0.0240	o	0.0190	o	0.0140	7	0.0090	o	0.0040
o	0.0489		0.0439	o	0.0389	o	0.0339	o	0.0289	o	0.0239	o	0.0189	o	0.0139	o	0.0089	~	0.0039
o	0.0488		0.0438	o	0.0388	o	0.0338	o	0.0288	o	0.0238	o	0.0188	o	0.0138	o	0.0088	o	0.0038
o	0.0487		0.0437	o	0.0387	o	0.0337	o	0.0287	o	0.0237	o	0.0187	o	0.0137	o	0.0087	17	0.0037
o	0.0486		0.0436	o	0.0386	o	0.0336	o	0.0286	o	0.0236	o	0.0186	o	0.0136	o	0.0086	o	0.0036
o	0.0485		0.0435	o	0.0385	o	0.0335	o	0.0285	o	0.0235	o	0.0185	o	0.0135	o	0.0085	7	0.0035
o	0.0484		0.0434	o	0.0384	o	0.0334	o	0.0284	o	0.0234	o	0.0184	o	0.0134	o	0.0084	o	0.0034
o	0.0483		0.0433	o	0.0383	o	0.0333	o	0.0283	o	0.0233	o	0.0183	o	0.0133	o	0.0083	o	0.0033
o	0.0482		0.0432	o	0.0382	o	0.0332	o	0.0282	o	0.0232	6	0.0182	o	0.0132	5 1	0.0082	o	0.0032
o	0.0481		0.0431	o	0.0381	o	0.0331	o	0.0281	o	0.0231	o	0.0181	o	0.0131	o	0.0081	o	0.0031
o	0.0480		0.0430	o	0.0380	o	0.0330	o	0.0280	o	0.0230	o	0.0180	o	0.0130	o	0.0080	o	0.0030
o	0.0479		0.0429	o	0.0379	o	0.0329	o	0.0279	o	0.0229	6	0.0179	o	0.0129	o	0.0079	o	0.0029
o	0.0478		0.0428	o	0.0378	o	0.0328	o	0.0278	o	0.0228	o	0.0178	o	0.0128	o	0.0078	o	0.0028
o	0.0477		0.0427	o	0.0377	o	0.0327	o	0.0277	o	0.0227	o	0.0177	o	0.0127	o	0.0077	o	0.0027
o	0.0476		0.0426	o	0.0376	o	0.0326	o	0.0276	o	0.0226	o	0.0176	o	0.0126	o	0.0076	o	0.0026
o	0.0475		0.0425	o	0.0375	o	0.0325	o	0.0275	o	0.0225	o	0.0175	o	0.0125	o	0.0075	o	0.0025
o	0.0474		0.0424	o	0.0374	o	0.0324	o	0.0274	o	0.0224	o	0.0174	o	0.0124	o	0.0074	o	0.0024
o	0.0473		0.0423	o	0.0373	o	0.0323	o	0.0273	o	0.0223	o	0.0173	o	0.0123	o	0.0073	o	0.0023
o	0.0472		0.0422	o	0.0372	o	0.0322	o	0.0272	o	0.0222	6	0.0172	o	0.0122	o	0.0072	o	0.0022
o	0.0471		0.0421	o	0.0371	o	0.0321	o	0.0271	o	0.0221	o	0.0171	o	0.0121	o	0.0071	o	0.0021
o	0.0470		0.0420	o	0.0370	o	0.0320	o	0.0270	o	0.0220	o	0.0170	o	0.0120	o	0.0070	o	0.0020
0	0.0469		0.0419	o	0.0369	o	0.0319	o	0.0269	o	0.0219	o	0.0169	o	0.0119	o	0.0069	o	0.0019
o	0.0468		0.0418	o	0.0368	o	0.0318	o	0.0268	o	0.0218	o	0.0168	o	0.0118	o	0.0068	o	0.0018
o	0.0467		0.0417	o	0.0367	o	0.0317	o	0.0267	o	0.0217	o	0.0167	o	0.0117	o	0.0067	o	0.0017
o	0.0466		0.0416	o	0.0366	o	0.0316	o	0.0266	o	0.0216	o	0.0166	o	0.0116	o	0.0066	-7	0.0016
o	0.0465		0.0415	o	0.0365	o	0.0315	o	0.0265	o	0.0215	o	0.0165	o	0.015	o	0.0065	o	0.0015
o	0.0464		0.0414	o	0.0364	o	0.0314	o	0.0264	o	0.0214	o	0.0164	o	0.0114	o	0.0064	00	0.0014
o	0.0463		0.0413	o	0.0363	o	0.0313	o	0.0263	o	0.0213	o	0.0163	o	0.0113	o	0.0063	7	0.0013
o	0.0462		0.0412	o	0.0362	o	0.0312	o	0.0262	o	0.0212	o	0.0162	o	0.0112	o	0.0062	o	0.0012
o	0.0461		0.0411	o	0.0361	o	0.0311	o	0.0261	o	0.0211	o	0.0161	o	0.0111	o	0.0061	o	0.0011
o	0.0460		0.0410	o	0.0360	o	0.0310	o	0.0260	o	0.0210	o	0.0160	o	0.0110	7	0.0060	o	0.0010
თ	0.0459		0.0409	o	0.0359	თ	0.0309	o	0.0259	o	0.0209	o	0.0159	თ	0.0109	7	0.0059	o	0.0009
o	0.0458		0.0408	o	0.0358	o	0.0308	o	0.0258	o	0.0208	o	0.0158	o	0.0108	o	0.0058	~	0.0008
o	0.0457		0.0407	o	0.0357	o	0.0307	o	0.0257	o	0.0207	0	0.0157	o	0.0107	o	0.0057	o	0.0007
თ	0.0456		0.0406	o	0.0356	თ	0.0306	o	0.0256	o	0.0206	o	0.0156	თ	0.0106	7	0.0056	~	0.0006
o	0.0455		0.0405	o	0.0355	o	0.0305	o	0.0255	o	0.0205	o	0.0155	თ	0.0105	7	0.0055	~	0.0005
o	0.0454		0.0404	o	0.0354	o	0.0304	o	0.0254	o	0.0204	o	0.0154	o	0.0104	o	0.0054	ⅎ	0.0004
თ	0.0453		0.0403	o	0.0353	თ	0.0303	o	0.0253	o	0.0203	o	0.0153	თ	0.0103	7	0.0053	00	0.0003
o	0.0452		0.0402	o	0.0352	o	0.0302	o	0.0252	o	0.0202	o	0.0152	o	0.0102	o	0.0052	49	0.0002
o	0.0451	o	0.0401	o	0.0351	o	0.0301	o	0.0251	o	0.0201	o	0.0151	o	0.0101	o	0.0051	288	0.0001
თ	0.0450		0.0400	o	0.0350	თ	0.0300	თ	0.0250	o	0.0200	o	0.0150	თ	0.0100	o	0.0050	260	0.0000

RUN 4: Decreasing Field, Random State

Between the first two images of the 6 spins, there is little difference even though the field had changed by about 0.03. At 0.21, the 6 spins undergo sudden and rapid changes in orientation. Eventually, the 6 spins rest in a near planar state, and gradually relax to a full planar state at B=0. When referring to the spin chart, it's clear that trying to visualize the entire lattice by choosing 6 spins won't work, since there are far more than 6 spins for the majority of fields. An alternate approach was used, which involved looking at a small, manageable section of the entire lattice.

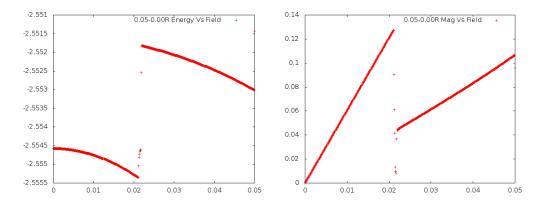


Figure 10: Energy vs decreasing field and Magnetization versus decreasing field

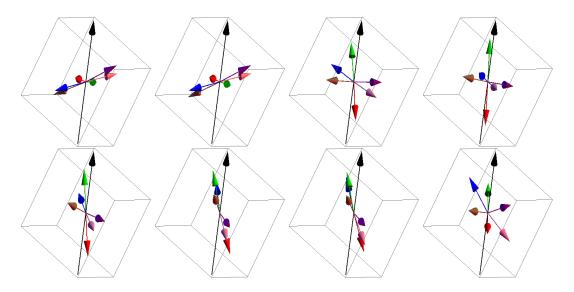


Figure 11: Snapshots of the 6 characteristic spins of the lattice over the course of increasing field

o	0.001	თ	00051	თ	0.0101	თ	0.0151	თ	000	70	0027	ÿ	00301	g	00351	204	0 0401	ņ	2
o	0.0002	o	0.0052	o	0.0102	o	0.0152	o	0.0202	82	0.0252	82	0.0302	92	0.0352	20	0.0402	88	0.0452
o	0.0003	o	0.0053	o	0.0103	o	0.0153	o	0.0203	82	0.0253	82	0.0303	8	0.0353	20	0.0403	8	0.0453
o	0.0004	o	0.0054	o	0.0104	o	0.0154	o	0.0204	82	0.0254	82	0.0304	-	0.0354	20	0.0404	œ	0.0454
o	0.0005	o	0.0055		0.0105	o	0.0155	o	0.0205	8	0.0255	20	0.0305	8	0.0355	20	0.0405	8	0.0455
o	0.0006	o	0.0056	o	0.0106	o	0.0156	o	0.0206	8	0.0256	82	0.0306	8	0.0356	82	0.0406	œ	0.0456
o	0.0007	o	0.0057	o	0.0107	o	0.0157	o	0.0207	8	0.0257	20	0.0307	8	0.0357	8	0.0407	20	0.0457
o	0.0008	o	0.0058	o	0.0108	o	0.0158	o	0.0208	82	0.0258	84	0.0308	9	0.0358	8	0.0408	22	0.0458
o	0.0009	o	0.0059	o	0.0109	o	0.0159	o	0.0209	82	0.0259	8	0.0309	8	0.0359	84	0.0409	82	0.0459
o	0.001	o	0.006	o	0.011	o	0.016	o	0.021	82	0.026	8	0.031	8	0.036	8	0.041	82	0.0460
0	0.0011	o	0.0061	o	0.0111	o	0.0161	00	0.0211	82	0.0261	8	0.0311	8	0.0361	8	0.0411	24	0.0461
o	0.0012	o	0.0062	o	0.0112	o	0.0162	ಕ	0.0212	œ	0.0262	8	0.0312	8	0.0362	8	0.0412	2	0.0462
o	0.0013	o	0.0063		0.0113	o	0.0163	9	0.0213	8	0.0263	8	0.0313	8	0.0363	2	0.0413	φ 4	0.0463
o	0.0014	o	0.0064	o	0.0114	o	0.0164	9	0.0214	20	0.0264		0.0314	8	0.0364	88	0.0414	8	0.0464
o	0.0015	o	0.0065		0.0115	o	0.0165	ⅎ	0.0215	8	0.0265	8	0.0315	92	0.0365	8	0.0415	8	0.0465
o	0.0016	o	0.0066		0.0116	o	0.0166	9	0.0216	88	0.0266		0.0316	92	0.0366	88	0.0416	88	0.0466
o	0.0017	o	0.0067	o	0.0117	o	0.0167	29	0.0217	88	0.0267	88	0.0317	92	0.0367	88	0.0417	84	0.0467
o	0.0018	o	0.0068	o	0.0118	o	0.0168	8	0.0218	8	0.0268	88	0.0318	92	0.0368	88	0.0418	φ 4	0.0468
o	0.0019	o	0.0069	o	0.0119	o	0.0169	ŧ	0.0219	8	0.0269	8	0.0319	92	0.0369	88	0.0419	8	0.0469
o	0.002	o	0.007	o	0.012	o	0.017	88	0.022	9	0.027	8	0.032	94	0.037	88	0.042	82	0.0470
o	0.0021	o	0.0071	o	0.0121	o	0.0171	œ	0.0221	9	0.0271	8	0.0321	8	0.0371	8	0.0421	8	0.0471
o	0.0022	o	0.0072	o	0.0122	o	0.0172	87	0.0222	20	0.0272	8	0.0322	8	0.0372	8	0.0422	8	0.0472
o	0.0023	o	0.0073	o	0.0123	o	0.0173	8	0.0223	8	0.0273	8	0.0323	8	0.0373	8	0.0423	8	0.0473
თ 1	0.0024	o	0.0074		0.0124	o	0.0174	84	0.0224	82	0.0274		0.0324	88	0.0374	8	0.0424	8	0.0474
	0.0025	o	0.0075		0.0125	თ	0.0175	8	0.0225	82	0.0275		0.0325		0.0375	2	0.0425	8	0.0475
o	0.0026	o	0.0076		0.0126	o	0.0176	83	0.0226	82	0.0276		0.0326		0.0376	8	0.0426	88	0.0476
o	0.0027	o	0.0077		0.0127	o	0.0177	8	0.0227	78	0.0277		0.0327		0.0377	8	0.0427	20	0.0477
o	0.0028	o	0.0078		0.0128	o	0.0178	22	0.0228	78	0.0278		0.0328		0.0378	8	0.0428	22	0.0478
o	0.0029	o	0.0079	o	0.0129	o	0.0179	20	0.0229	8	0.0279		0.0329		0.0379	8	0.0429	8	0.0479
o	0.003	o	0.08	o	0.013	o	0.018	20	0.023	8	0.028	8	0.03		0.038	82	0.043	8	0.0480
o	0.0031	o	0.0081	o	0.0131	o	0.0181	20	0.0231	8	0.0281		0.0331		0.0381	8	0.0431	82	0.0481
o	0.0032	o	0.0082	o	0.0132	o	0.0182	8	0.0232	7	0.0282		0.0332	8	0.0382	82	0.0432	20	0.0482
o	0.0033	o	0.0083	o	0.0133	o	0.0183	8	0.0233	78	0.0283		0.0333	8	0.0383	20	0.0433	22	0.0483
o	0.0034	o	0.0084	o	0.0134	o	0.0184	82	0.0234	78	0.0284		0.0334		0.0384	8	0.0434	20	0.0484
o	0.0035	o	0.0085		0.0135	o	0.0185	8	0.0235	78	0.0285		0.0335		0.0385	8	0.0435	20	0.0485
o	0.0036	o	0.008		0.0136	o	0.0186	82	0.0236	79	0.0286		0.0336		0.0386	82	0.0436	20	0.0486
o	0.0037	o	0.0087	o	0.0137	o	0.0187	8	0.0237	78	0.0287		0.0337		0.0387	8	0.0437	8	0.0487
o	0.00	o	0.00	o	0.0138	o	0.0188	으	0.0238	8	0.0288		0.038		0.0388	8	0.0438	8	0.0488
o	0.0039	o	0.0089	o	0.0139	o	0.0189	8	0.0239	으	0.0289		0.0339		0.0389	22	0.0439	8	0.0489
o	0.004	o	0.009	o	0.014	o	0.019	78	0.024	8	0.029	29	0.034	8	0.039	œ	0.044	8	0.0490
7	0.0041	o	0.0091	o	0.0141	o	0.0191	78	0.0241	8	0.0291	82	0.0341	8	0.0391	88	0.0441	8	0.0491
o	0.0042	o	0.0092	o	0.0142	o	0.0192	8	0.0242	8	0.0292	8	0.0342	20	0.0392	8	0.0442	8	0.0492
o	0.0043	o	0.0093	o	0.0143	o	0.0193	8	0.0243	8	0.0293		0.0343	8	0.0393	22	0.0443	8	0.0493
o	0.0044	o	0.0094	o	0.0144	o	0.0194	8	0.0244	8	0.0294		0.0344	8	0.0394	8	0.0444	8	0.0494
o	0.0045	o	0.0095		0.0145	o	0.0195	8	0.0245	8	0.0295		0.0345	88	0.0395	29	0.0445	8	0.0495
	0.0046	o	0.0096		0.0146	o	0.0196	78	0.0246	82	0.0296		0.0346	8	0.0396	82	0.0446	8	0.0496
o	0.0047	o	0.0097		0.0147	o	0.0197	8	0.0247	82	0.0297		0.0347		0.0397	8	0.0447	8	0.0497
o	0.0048	o	0.0098	o	0.0148	თ	0.0198	78	0.0248	82	0.0298		0.0348	88	0.0398	8	0.0448	8	0.0498
o	0.0049	o	0.0099		0.0149	o	0.0199	78	0.0249	8	0.0299		0.0349	8	0.0399	8	0.0449	92	0.0499
c	9.000	•		•	9 6 6	•	9	(

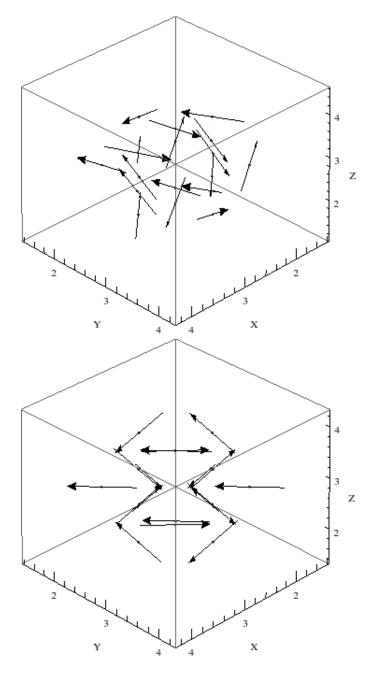


Figure 12: Visualization of a small section of the entire lattice used in RUN 3. The spins are initially highly disordered, until they snap into a final planar configuration.

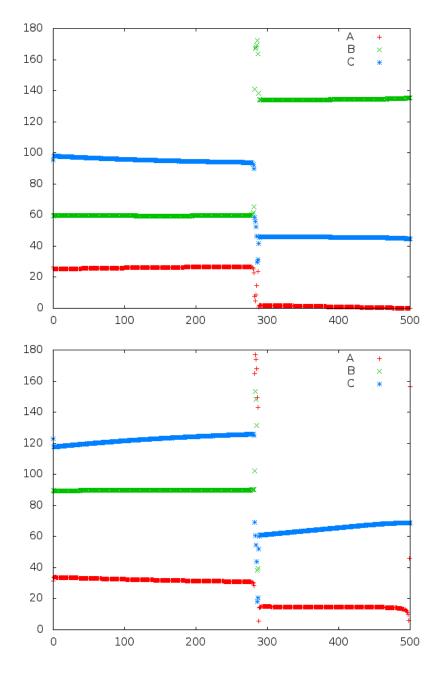


Figure 13: The angles are those between a chosen vector lying in the plane intersected by 111, and a projection of each of the A, B, and C spins. Azimuthal angles are followed by zenith angles.

Appendices

Appendix A - Finding Unique Spins

Overview This script finds all confxxxx.f90 files in the current directory, scans through each of them, and finds each unique spin that occurs within that conf file. The script outputs the name of the conf file followed by the number of unique spins that exist in that file, and each unique spin that exists in the file. A spin is considered unique when it has never been encountered before; that is, it does not already exist in a temporary file that stores all unique spins encountered for the current conf file. A spin is considered unique when it does not match any of the spins contained within this file up to some pre-determined decimal places. If the number of unique spins within the conf file surpasses a number of spins (specified by the first argument) the spins will not be added to resulting uniqueSpins.txt file.

```
#!/bin/bash
#findUnique.sh Andrew Way arw405@mun.ca
if [[ $# < 2 ]];then</pre>
echo "Usage: ./findUniqueRx.sh uniqueSpinLimit NumberOfCharacters"
echo "Exiting."
exit 1
fi
rm debug.txt
rm spinSummary.txt
rm spinFrequency.txt
touch spinSummary.txt
touch spinFrequency.txt
touch debug.txt
for i in conf*
do
   echo "Working on $i"
   confLength='cat $i | wc -l'
   echo 'cat $i | head -n 1 | tail -n 1' > uniqueTmp.txt
   for line in 'seq 2 $confLength'
       text='cat $i | head -n $line | tail -n 1'
   verdict="unique"
   spinA='echo $text | awk '{print $1;}' | cut -c1-$2'
   spinB='echo $text | awk '{print $2;}' | cut -c1-$2'
   spinC='echo $text | awk '{print $3;}' | cut -c1-$2'
   #echo "$i $spinA $spinB $spinC" >> debug.txt
   USLength='cat uniqueTmp.txt | wc -1'
   for j in 'seq 1 $USLength'
      tmpSpin='cat uniqueTmp.txt | head -n $j | tail -n 1'
           tmpSpinA='echo $tmpSpin | awk '{print $1;}' | cut -c1-$2'
```

```
tmpSpinB='echo $tmpSpin | awk '{print $2;}' | cut -c1-$2'
      tmpSpinC='echo $tmpSpin | awk '{print $3;}' | cut -c1-$2'
      if [ $tmpSpinA == $spinA ] && [ $tmpSpinB == $spinB ] && [ $tmpSpinC == $spinC ]
      then
     verdict="notUnique"
      fi
   # echo "tmpSpins $tmpSpinA $tmpSpinB $tmpSpinC" >> debug.txt
  if [ $verdict == "unique" ];then
     echo $text >> uniqueTmp.txt
  fi
   done
   USLength='cat uniqueTmp.txt | wc -1'
   echo "Unique spins: $USLength"
   echo "$i : $USLength" >> spinSummary.txt
   if [[ $USLength -le $1 ]];then
  for j in 'seq 1 $USLength'
      echo 'cat uniqueTmp.txt | head -n $j | tail -n 1' >> spinSummary.txt
  done
  else
      echo "unique spin limit surpassed for $i" >> spinSummary.txt
  echo "$i $USLENGTH" >> spinFrequency.txt
  rm uniqueTmp.txt
done
```