<table>
<thead>
<tr>
<th>Chapters</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. <strong>Introduction</strong></td>
<td>1</td>
</tr>
<tr>
<td>1.1 Phase transitions in low-dimensional systems</td>
<td>2</td>
</tr>
<tr>
<td>1.2 Two-dimensional melting: experimental observations</td>
<td>6</td>
</tr>
<tr>
<td>1.2.1 Studies on liquid-crystal films</td>
<td>7</td>
</tr>
<tr>
<td>1.2.2 Studies on rare gases adsorbed on graphite substrate</td>
<td>9</td>
</tr>
<tr>
<td>1.2.3 Studies on electrons on the surface of liquid helium</td>
<td>11</td>
</tr>
<tr>
<td>1.2.4 Studies on charged sub-micron sized spheres</td>
<td>12</td>
</tr>
<tr>
<td>1.3 Two-dimensional melting: theoretical understanding</td>
<td>12</td>
</tr>
<tr>
<td>1.3.1 Order parameters, symmetries and correlation</td>
<td>13</td>
</tr>
<tr>
<td>1.3.2 Topological defects</td>
<td>15</td>
</tr>
<tr>
<td>1.3.3 Vortex unbinding transition: KT theory</td>
<td>19</td>
</tr>
<tr>
<td>1.3.4 Dislocation mediated melting: KTHNY theory</td>
<td>20</td>
</tr>
<tr>
<td>1.3.5 Analogy with magnetism</td>
<td>22</td>
</tr>
<tr>
<td>1.4 Two-dimensional magnetization: experimental observations</td>
<td>23</td>
</tr>
<tr>
<td>1.5 Two-dimensional magnetism: theoretical understanding</td>
<td>26</td>
</tr>
<tr>
<td>1.5.1 General theory of ferromagnetism and spin waves</td>
<td>26</td>
</tr>
<tr>
<td>1.5.2 Absence of long-range ordering: Mermin-Wagner theorem</td>
<td>30</td>
</tr>
<tr>
<td>1.5.3 Long-range magnetic order in presence of dipolar interaction</td>
<td>32</td>
</tr>
<tr>
<td>1.5.4 Magneto-crystalline anisotropic interaction</td>
<td>33</td>
</tr>
<tr>
<td>1.5.5 Spin-waves in presence of exchange, dipole and magneto-crystalline anisotropic interactions</td>
<td>34</td>
</tr>
<tr>
<td>1.5.6 Stripe domain formation in 2D magnetic layers</td>
<td>36</td>
</tr>
<tr>
<td>1.6 Outline of the present work</td>
<td>37</td>
</tr>
<tr>
<td>2. <strong>Experimental Techniques</strong></td>
<td>40</td>
</tr>
<tr>
<td>2.1 Langmuir-Blodgett deposition technique</td>
<td>41</td>
</tr>
<tr>
<td>2.1.1 Preparation of Langmuir monolayer</td>
<td>41</td>
</tr>
</tbody>
</table>
2.1.2 Deposition of LB films ................................. 46
2.2 X-ray and Neutron scattering techniques .................. 50
  2.2.1 X-ray and Neutron reflectivity basic formalism ..... 52
  2.2.2 Instrument for X-ray reflectivity study ............. 60
  2.2.3 Instrument for Neutron reflectivity study ..... 62
  2.2.4 X-ray grazing incidence diffraction ................. 66
  2.2.5 Polarized neutron reflectivity .... 70
2.3 Instrument for magnetization measurements ............ 74

  3.1 Introduction ............................................. 80
  3.2 Experimental details .................................. 85
  3.3 Analysis scheme ...................................... 87
  3.4 Experimental results .................................. 89
  3.4.1 Structure of divalent fatty acid salt LB films ... 89
  3.4.2 Structure of preformed trivalent fatty acid salt LB films ... 94
  3.5 Conclusions ........................................... 103

4. Two-dimensional to three dimensional melting transition in Langmuir-Blodgett Films ........................... 105
  4.1 Introduction ............................................. 106
  4.2 Experimental details .................................. 110
  4.2.1 The sample cell ................................... 111
  4.2.2 X-ray Reflectivity studies ....................... 112
  4.2.3 Grazing incidence diffraction studies ............. 113
  4.3 Data analysis .......................................... 114
  4.3.1 Energy dispersive reflectivity .................... 114
  4.3.2 Grazing incidence diffraction ..................... 118
  4.4 Model and interpretation ............................. 123
  4.5 Conclusions ........................................... 126

5. Two-dimensional magnetic ordering in Langmuir-Blodgett films ......................................................... 127
  5.1 Introduction ............................................. 128
  5.2 Experimental details .................................. 131
  5.2.1 Sample preparation and characterization ......... 131
  5.2.2 Magnetization measurements ...................... 132
  5.3 Structure characterization of GdSt LB films .......... 133
  5.4 Short-range ferromagnetic ordering: results of VSM measurements .... 134
  5.5 Magnetic structure of LB films: Neutron reflectivity study .... 139
5.6 Anisotropic interactions in ferromagnetic ordering: results of sub-Kelvin magnetization measurements ............................................................. 143
5.7 Conclusions ........................................................................................................146

Bibliography ............................................................................................................... 147