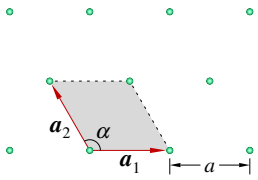
Group Theory
Homework Assignment 09
Spring, 2020

Consider the two-dimensional triangular Bravais lattice (also referred to as the hexagonal Bravais lattice) shown in the figure.



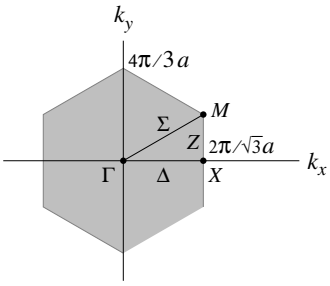
The basic lattice vectors are given by

$$a_1 = a\,e_x, \quad a_2 = -(a/2)\,e_x + (\sqrt{3}a/2)\,e_y.$$

1. Find the crystallographic point group of the triangular Bravais lattice. What is the space group of the triangular Bravais lattice in the international system?

2. Construct the character table for the crystallographic point group of the triangular Bravais lattice.

3. Find the basic lattice vectors of the reciprocal lattice of the triangular Bravais lattice. Show that the first Brillouin zone of the triangular Bravais lattice is as given in the following figure.



4. Find the point groups for the $\vec{k}$-vectors: $\vec{k}_\Gamma = \vec{0}$, $\vec{k}_X$, and $\vec{k}_M$.

5. Identity the symmetry axes and their point groups in the first Brillouin zone of the triangular Bravais lattice.