Optical lattices

By Definition an Optical Lattice is a periodic light shift potential where cold atoms can be trapped.
The ways to construct an Optical Lattice is by using laser beams and make standing waves. In the case of one dimension it might look like in Fig 1.

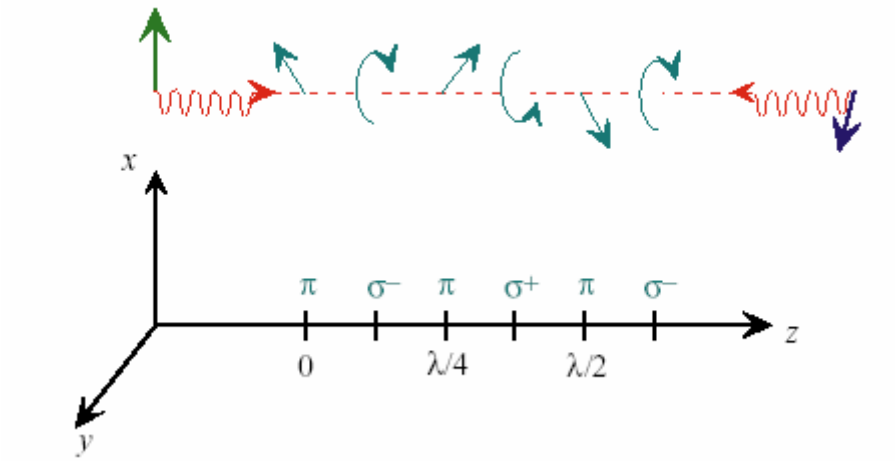

Fig 1
This should resembling two counter propagating, red detuned, laser beams with orthogonal linear polarization

If we go on and look at lattices with higher dimensions you have to se more Lasers and put them with specific angles toward each other. In fact for an N-dimension lattice you need N+1 laser beams. For two dimensions it might be constructed like the one in Fig 2.

Fig 2

There are also some desired features for a two dimension lattice.

. Light shift potential minima at points of pure circular polarization.
. Cancelled radiation pressure force at the trap centres.

If we then look at the three dimensions case the arrangement might look like in Fig 3 this will give a face centred tetrahedral lattice.

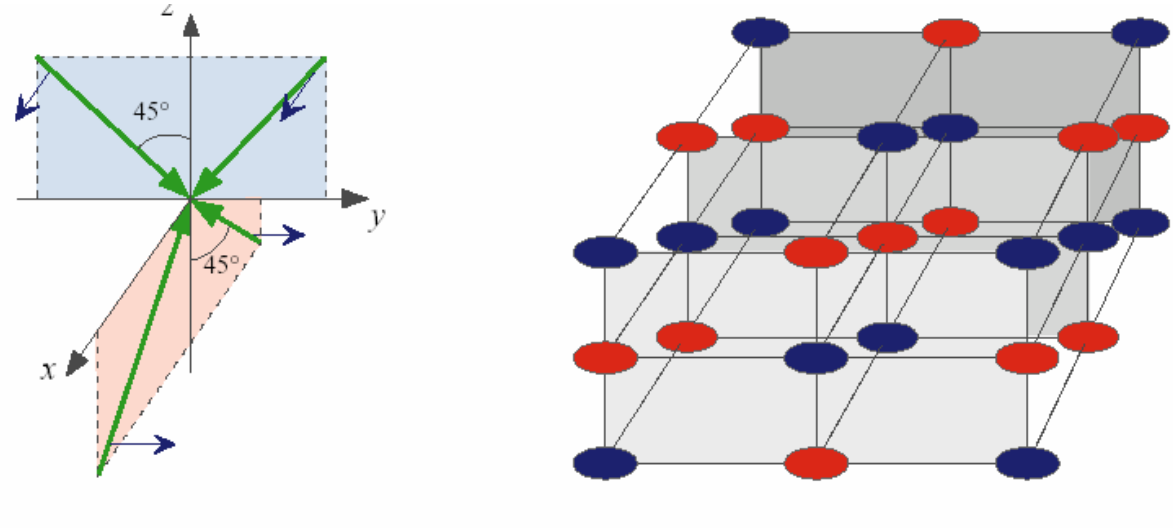

Fig 3

Why are people interested in Optical Lattices?

One reason is that with an Optical Lattice you will get a lattice that is free from defects. Another reason is that you know exactly how the potential is shaped. Final you will be able to change the depth of the potential without changing the lattice vector.

With these three properties the Optical lattice is perfect to study quantum behaviour in lattices.