QUDEDIS - Short Visit Grant- 1718

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As mentioned in the application project the purpose of my visit (19-30 March) at the Rutherford Appleton Laboratory (ISIS facility) was to study how the Fermi surface of a quantum fluid re-arranges itself, breaking rotational symmetry, at the Pomeranchuk instability. This phase transition is particularly subtle because no other symmetry is broken - in particular, the quantum fluid remains homogeneous. During the visit I became familiar with the recently developed microscopic theory of rotational symmetry-breaking through the Pomeranchuk instability [1, 2]. We discussed the type of fermion-fermion interactions which may account for the Pomeranchuk instability. In a lattice model, both on-site attractive interactions and repulsive nearest-neighbours interactions are required. Such scenario may be realised with a dipolar Fermi gas in optical lattices through dipole-dipole interactions.

In addition, we started a new project concerning the dynamics of single particle in a tight-binding lattice with a harmonic potential superimposed. Recently, the existence of localised states in this model has received a big deal of attention [3, 4, 5, 6, 7] enhanced after its experimental realisation through sudden displacement of the harmonic trap [8, 9]. Our interest concerns the tunneling dynamics of initially localised states created by sloshing, an in particular, the behaviour near the thermodynamic limit. During a visit to the Physics Department at the University of Birmingham we discussed the details of the problem with Sam Carr who joined the project. We now plan to continue the collaboration and it is our intention to submit the results for publication during the next months.

References

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