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SUPERSYMMETRY IN QUANTUM MECHANICS

Supersymmetric (SUSY) quantum mechanics was introduced by Witten as a laboratory for investigating SUSY breaking which is one of the fundamental issue in SUSY quantum field theory. Priory to Witten's paper Nicolai had shown that SUSY could be also a useful tool in nonrelativistic quantum mechanics. Subsequently SUSY quantum mechanics has proven to be interesting on its own merit.

The SUSY was discovered in some real quantum mechanical systems. The motion of the electron in the magnetic field is an interesting example of such system. It was shown that the SUSY with two supercharges ($N = 2$ SUSY) is realized in two dimensional case for arbitrary magnetic field perpendicular to plane. It was found also some special three dimensional magnetic field in which motion of the electron is supersymmetric. New aspect in this case is realization of SUSY with $N = 2, 3$ and 4 supercharges. Note that the supersymmetry leads to the degeneracy of the non zero energy levels $2^{\lfloor N/2 \rfloor}$.

Over the years it has been shown also that SUSY quantum mechanics plays an important role in obtaining exact solutions of quantum mechanical problems. In fact, all solvable problems of quantum mechanics are supersymmetric or can be made so. In frame of SUSY quantum mechanics some progress was achieved also in the investigation of the quasi exactly solvable problems for which only finite number of the energy levels and corresponding wave functions can be found in explicit form.