



DOTTORATO DI RICERCA
UNIVERSITÀ DI PISA

DIPARTIMENTO DI FISICA "ENRICO FERMI"

Scuola di Dottorato in Scienze di base "Galileo Galilei"

Ciclo di lezioni

1, 8, 15, 22 e 29 Marzo 2012

ore 16:00 - Aula V1 - Polo Fibonacci

Dr S. Soskin

Inst. of Semiconductor Physics - Kiev

"Selected topics of PHYSICS OF HAMILTONIAN CHAOS and its applications. Part 1: SEPARATRIX CHAOS."

An informal mini-course of five lectures on the separatrix chaos, which is a germ of any chaos in low-dimensional Hamiltonian systems, and on its applications in physics. The emphasis will be done on new developments in the subject and on their applications.

The new developments include:

- i. a development of a new method of an analytic treatment of the separatrix chaotic layer in the range where its width is maximal;
- ii. an application of the method to the single-separatrix case, that has allowed us to solve one of the major problems in the subject – about the maximum width of the chaotic layer at a given perturbation amplitude – the problem which was posed more than 40 years ago but appeared to be unsolvable since then;
- iii. an application of the method to the onset of global chaos between two neighboring separatrices: it has allowed us to find a new phenomenon – a drastic facilitation of the onset of global chaos between separatrices in the vicinity of certain frequencies of perturbation – that has a great potential for applications;
- iv. a number of exciting applications, relating in particular to:
 - (1) classical and quantum transport in semiconductor superlattices;
 - (2) SQUIDs, pendulum, cold atoms in optical lattices;
 - (3) meandering flows, in particular the Gulf Stream;
 - (4) noise-induced escape in a variety of systems;
 - (5) facilitated onset of an overlap of resonances.

LECTURE 1 gives a brief overview of the subject of separatrix chaos.

LECTURE 2 presents a general description of the new method of the treatment of separatrix chaos.

LECTURE 3 is devoted to the application of the method to the single-separatrix chaotic layer, concentrating on the solution of the problem of its maximal width.

LECTURE 4 shows the application of the method to the double separatrix chaos, concentrating on the description of the drastic facilitation of the onset of global chaos.

LECTURE 5 describes a number of physical applications.

R.Mannella