

## ESF - Short Visit Grant - Final Report

The applicant gave the talk entitled « The Superfluidity phenomenon in dilute Bose Gas. Is everything understood ? ». He presented the microscopic kinetic theory of a homogeneous dilute Bose condensed gas in the generalized random phase approximation (GRPA), which satisfies the following requirements:

- 1) the mass, momentum and energy conservation laws;
- 2) the H-theorem;
- 3) the superfluidity property and
- 4) the recovery of the Bogoliubov theory at zero temperature.

Contrary to previous approaches, these requirements impose a totally different understanding on the superfluidity phenomenon. Indeed, as long as the Bose gas is stable, no binary collision happens between condensed and normal atoms due to the ability of the condensate wavefunction to attenuate totally the interatomic forces. As a consequence, no relaxation of any initial relative velocity between the normal and superfluid occurs and the superfluid moves without any friction.

Informal discussions took place between Patrick Navez, Prof. Kazimir Rzazewski and Marius Gajda during the rest of the stay. The conclusion was that a joint collaboration is possible on the following :

They have planed to study various superfluidity processes through the thermal field approach developed by Prof. Kazimir Rzazewski. Namely, they have decided to study the persistence of the relative velocity between the normal and the superfluid as well as the their critical velocity above which friction appears. They also envisage to study the superfluidity of an impurity embeded in a Bose gaz.