

Laudatio for Sylvia Serfaty by B. Helffer.

It is a great pleasure to present to you Sylvia Serfaty who receives the Henri Poincaré Prize.

Sylvia Serfaty works on problems in Partial Differential Equations and Non Linear Analysis mostly motivated by Physics. She has worked in micromagnetism but mainly on the Ginzburg-Landau functional in superconductivity, exploring the analysis of the minimizers, of the critical points and looking also at associated time-dependent problems. More recently, extensions of this work has led to the analysis of models in statistical mechanics related to the bi-dimensional Coulomb gas.

To come back to her work in superconductivity, the program was to show that if the superconducting material is of type II (large κ) and submitted to an external magnetic field, one observes, starting from some critical intensity, vortices whose localization is progressively organized when the external field

increases on a triangular lattice called the Abrikosov lattice. This beautiful achievement has been performed in collaboration with Etienne Sandier and the first part of this work is presented in a fundamental book.

I know Sylvia Serfaty from the time where she was student in Ecole Normale Supérieure. At the moment of deciding the subject of her PHD, she was discussing with me and I propose, as far as I remember, to Sylvia to work on magnetic Schrödinger operators in connexion with the analysis of the third critical field in superconductivity. She finally decides to work with Fabrice Béthuel on the first critical field. So at this time the question was for her to decide if she was preferring to work with decaying external fields or increasing external fields. At the end, one finally arrives at the second critical field from above or from below.

If one remembers the state of the art in the mid-nineties, the work of H. Brézis and collaborators on Ginzburg-Landau was permitting to develop powerful techniques but was not treating the most

physical problem and the role of the external magnetic field was not well understood.

The very good surprise was that these techniques can be adapted to treat the magnetic case in the analysis of vortices.

All the work of Sylvia is characterized by a very clever use of mathematical analysis and the choice of nice mathematical problems strongly motivated by physics.

In Google I learned that Sylvia has as bedside book the book of Douglas Hofstadter « *Gödel-Escher-Bach: An Eternal Golden Braid* ». May be this will prepare new contributions on the celebrated Hofstadter's butterfly which she cannot have missed when reading the book.

To finish, let me congratulate Sylvia for her magnificent work and because it is a laudatio we should say in latin : *Laudamus Sylviam* !