

## ANALYSIS OF NONLINEAR PDES FROM GEOMETRY : FROM HARMONIC MAPS TO YANG-MILLS THEORY

Conformal invariance plays an important role in physics and geometry: conformal field theory, general relativity, superconductivity, Riemann surface, Yang-Mills fields. In this course we will study the analytical aspect of some of these problems. More precisely, we will be interested in the analysis of nonlinear PDEs resulting from conformal invariant problem: harmonic maps, prescribed curvature problem, Ginzburg-Landau and Yang-Mills.

We will start with the constant mean curvature equation which will allow me to introduce the phenomena of compactness by compensation, then we will develop the theory via the general approach of Rivière [2]. Then we will focus on the Ginzburg-Laundau problem [3], which can be considered as an abelian version of Yang-Mills. Finally, we will study Uhlenbeck's work on the Yang-Mills equation and if time permits we will give geometric applications [1].

**Background:** elliptic PDE, differential geometry.

### REFERENCES

- [1] Daniel S. Freed and Karen K. Uhlenbeck. *Instantons and four-manifolds*, volume 1 of *Mathematical Sciences Research Institute Publications*. Springer-Verlag, New York, second edition, 1991.
- [2] Tristan Rivière. *Conformally invariant variational problems*. 2012.
- [3] Etienne Sandier and Sylvia Serfaty. *Vortices in the magnetic Ginzburg-Landau model*, volume 70 of *Progress in Nonlinear Differential Equations and their Applications*. Birkhäuser Boston, Inc., Boston, MA, 2007.