**Name of the Host Laboratory**  
CMAP

**Website of the Host Laboratory**  
https://portail.polytechnique.edu/cmap/fr

**Research Group**  

**Internship Supervisor**  
Jing-Rebecca Li, http://www.cmap.polytechnique.fr/~jingrebeccali/

**Internship Subject**  
Partial differential equations for diffusion MRI modeling

**Student's level**  
- Advanced Undergraduate Students (3rd or 4th year)  
- Master's students (1st or 2nd year)  
- PhD students

**Proposed Duration**  
- 3 months  
- 4 months  
- 5 months  
- 6 months

**Prerequisites**  
Knowledge of PDEs, finite elements, Matlab.

**Internship description (max. 15 lines)**  
SpinDoctor is a software package that performs numerical simulations for diffusion magnetic resonance imaging for prototyping purposes. It solves the Bloch-Torrey equation, which is a diffusive PDE, to obtain the diffusion MRI signal. The PDE is solved by P1 finite elements combined with built-in Matlab routines for solving ordinary differential equations. The finite element mesh generation is performed using an external package called Tetgen. The intern will help to formulate a new representation of the diffusion MRI signal based on Fourier series. The intern will test the resulting new numerical algorithm and study the effects of the Fourier periodicity box size and the number of Fourier modes on the quality of the signal approximation. If the intern makes good progress during the internship, we expect to submit the results for publication as a scientific article.

Software, see [https://github.com/jingrebeccali/SpinDoctor](https://github.com/jingrebeccali/SpinDoctor)