Master 2: *International Centre for Fundamental Physics*

INTERNSHIP PROPOSAL

(One page maximum)

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Thesis possibility after internship: YES
Funding: NO

Mechanics of cytoskeleton: from bending to stretching rigidity

Cytoskeleton contains a network of semi-flexible actin fibers that can transmit mechanical loads by both stretching and bending. The goal of this project is to study the transitional behavior of general network materials whose elasticity can be actively switched from bending dominated to stretching dominated mode. The challenge is to build a continuum description capturing both regimes. The connectivity of the network, varying with loading, can be interpreted as a bond rupture process and the challenge is to demonstrate that stretching to bending transition proceeds through nucleation and propagation of multiple diffuse fronts separating domains with dissimilar rigidity. A related PhD project will focus on the study of conditions of self-organization towards stretching to bending criticality.

References:

1. Sheinman, M., C. P. Broedersz, and F. C. MacKintosh. "Nonlinear effective-medium theory of disordered spring networks." Physical Review E 85.2 (2012): 021801.
2. Müller, Kei W., Christian J. Cyron, and Wolfgang A. Wall. "Computational analysis of morphologies and phase transitions of cross-linked, semi-flexible polymer networks." Proc. R. Soc. A. Vol. 471. No. 2182. 2015.
3.Licup, Albert James, Abhinav Sharma, and Fred C. MacKintosh. "Elastic regimes of subisostatic athermal fiber networks." Physical Review E 93.1 (2016): 012407.

Please, indicate which speciality(ies) seem(s) to be more adapted to the subject:

Condensed Matter Physics: YES Macroscopic Physics and complexity: YES
Quantum Physics: YES/NO Theoretical Physics: YES