Master's thesis and/or Ph.D. thesis opening

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Mechanical response of branched actin networks

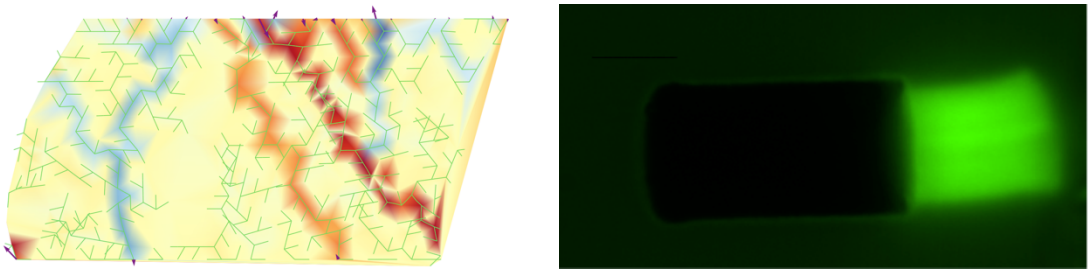
(theoretical thesis)

The architecture of living cells is largely determined by a microscopic networks of semiflexible filaments : the actin cytoskeleton. In addition to ensuring the cell's mechanical integrity, its growth enables cellular motion and force exertion. These crucial roles are played by so-called branched actin networks, which are random fractal assemblies of filaments and branching points.

Despite its importance within the cell, the rigidity of these networks is not understood from a theoretical standpoint. Indeed, taking into account the sole rigidity of the filaments and attachment points, we would predict a vanishing elastic modulus, in contradiction with experiments. *We will examine the origin of these networks' rigidity, considering in particular the effects of the entanglement of the network with itself, which generates nonlocal interactions between the points of the elastic network.* Given the difficulty of treating such interactions exactly, we will resort to mean-field approaches whose validity will be assessed numerically.

From an experimental perspective, our collaborators Olivia du Roure and Julien Heuvingh (ESPCI) operate a setup allowing the first clean characterization of the branched network. We will work with them to relate our models to the characteristics of a network grown under force (similar to *in vivo* conditions), its nonlinear elasticity *etc.*

Informal inquiries welcome.



Numerical model & *in vitro* growth of a branched network