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Nonlinear elasticity of composite networks of stiff biopolymers with flexible linkers CHASE BROEDERSZ, Vrije Universiteit, C. STORM, Vrije Universiteit and Universiteit Leiden, F.C. MACKINTOSH, Vrije Universiteit —
Motivated by recent experiments showing novel rheological properties of biopolymer networks, we develop an effective medium theory for rigid filaments cross-linked by flexible linkers. Specifically, we treat such a network as a collection of randomly oriented stiff polymers mechanically connected by highly compliant cross-linkers to an elastic continuum, which effectively represents the surrounding network. For cross-links with a finite compliance, we find a smooth cross-over between two distinct elastic regimes. Starting from a linear elastic regime dominated by cross-link elasticity, the network begins to stiffen significantly as the cross-links reach full compliance. We extend this model to a self-consistent one, in which the effective medium reflects the non-linear elastic properties of the cross-linked network. This model yields a cross-over to a nonlinear regime that is consistent with recent experimental studies of the cellular cytoskeletal polymer F-actinwith filamin cross-links[1].

1. ML Gardel, F Nakamura, J Hartwig JC Crocker, TP Stossel, DA Weitz, **103**, 1762 Proc. Nat. Ac. Sci. (2006).

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