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Random networks of cross-linked directed polymers PANAYOTIS BENETATOS, Cavendish Laboratory, University of Cambridge, UK and University of Goettingen, Germany, STEPHAN ULRICH, University of Goettingen, Germany, ANNETTE ZIPPELIUS, University of Goettingen and Max Planck Institute for Dynamics and Self-Organization, Germany — We consider a system of directed polymers confined between two planes with their end-points free to slide on them and we introduce random permanent cross-links. We treat the cross-links as quenched disorder and we use a semimicroscopic replica field theory to study the structure and elasticity of this system. Starting from the sol phase and increasing the cross-link density, we get a continuous gelation transition signaled by the emergence of a finite in-plane localization length. The distribution of localization length turns out to depend on the height along the preferred direction of the directed polymers. The gelation transition also gives rise to a finite in-plane shear modulus which we calculate and turns out to be universal, i.e., independent of the energy and length scales of the polymers and the cross-links. Using a symmetry argument, we show that cross-links of negligible extent along the preferred axis of the directed polymers do not cause any renormalization to the tilt modulus of the un- cross-linked system.

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