Abstract:
In homogeneous materials, discrete and continuous distributions of dislocations are often modeled by different geometric objects - typically, a body with a finite number of dislocations is modeled as a Riemannian manifold with singularities, while a body with a continuous distribution of defects is modeled as a smooth manifold with a non-Riemannian affine-connection (e.g. a metric connection with a non-zero torsion tensor). There are several approaches to how does this connection (or torsion tensor) manifests in the mechanical behavior of a body -- in some works it appears as part of the elastic energy associated with it, and in some it is related only to plastic deformations. In this talk I will present a rigorous homogenization theorem for distributed dislocations, thus bridging between the different approaches modeling them. This will be achieved by introducing a new notion of convergence of manifolds, which applies to this class of homogenization problems. Then I will present a Gamma-convergence result for elastic energies of converging elastic bodies, from which we will deduce that the torsion tensor can appear in the mechanical modeling of the body only when considering plastic deformations. Based on a joint work with Raz Kupferman.