Nonlocal equations and applications

We would like to give an introductory presentation of some equations which exhibit some nonlocal phenomena. Often, the nonlocal effect is modeled by a diffusive operator which is (in some sense) elliptic and fractional. Natural examples arise from probability, geometry, quantum physics, phase transition theory and crystal dislocation dynamics. We will try to discuss some of the mathematical tools that are useful to deal with these problems, explain in detail some of the main motivations and describe some recent results on these topics.