This project is devoted to the study of *self-similar* stochastic processes and focuses mainly on the physical models that might lead to such objects. Self-similar processes are called such because they exhibit scaling properties. This means that in their case the change of time is roughly equivalent to the change of scale. Intuitively, making our process run faster is equivalent to multiplying its values by a constant depending on the time acceleration. Many of the most famous stochastic processes are self-similar including Brownian motion, fractional Brownian motion and stable Lévy processes.

There are various *functional limit theorems* leading to self similar-processes. This is because under some very mild assumptions, if partial sums of stationary sequences of the form $S_n = \sum_{j=1}^{[Nt]} X_j$ (after normalization) converge in a suitable sense, as $N \to \infty$, then the resulting limit process (indexed by $t \geq 0$) must be self-similar.

We plan to focus on systems of moving particles and their aggregate behaviour at large scales (timewise and spacewise alike). Taking some *snapshots* of their behaviour at increasing time or space parameters was shown to lead to a great number of already known self-similar processes and might be fruitful in discovering some new ones.

Until now, so called *particle representations* were available mainly for finite-variance processes. We are planning to establish such connections to a number of processes discovered very recently. They have been first introduced, using the so-called *random walk in random environment model.* This can be shortly summarized as follows. Imagine a *user* wandering randomly around a *network.* The *user* picks some *rewards* at every point of the *network* they visit. We then add up al the *rewards.* Considering a very large number of *walkers* wandering independently and collecting independent *rewards* leads to the aforementioned processes. These, however, are *stable* processes which means that we can no longer apply some of the tools used in the Gaussian case and must rely on other techniques.

We would also like to focus on the random *fields* and find out whether the moving particles model may, after some necessary generalizations, provide a physical representation of some of them. Random fields have a very complicated fractal-like structure and it seems that discovering a physical interpretation can provide a more intuitive approach to their study.