Model theory is a branch of mathematical logic focused on the study of models (in other words, structures) of an arbitrary theory (in the sense of mathematical logic), i.e. it investigates the structure of the models and tries to compare or even to classify them. A fundamental notion in model theory is the notion of a definable set (i.e. a set which can be "defined" using the language of the theory in question; more precisely, it is the set of realizations of some formula in this language).

The core of contemporary model theory is stability theory (i.e. the model theory of stable theories and structures) developed by Shelah, Hrushovski, Pillay and others. This is a deep and sophisticated theory, with beautiful structural theorems and important applications in other branches of mathematics (mainly in algebraic geometry). One of the most important examples of stable structures are algebraically closed fields (e.g. the field of complex numbers). It turns out, however, that many important mathematical structures are unstable (e.g. the field of real numbers). That is why, over the last twenty years, main efforts in model theory have been undertaken to extend stability theory to wider classes of theories, covering the theories of many important mathematical structures which are unstable. This has led to the development of the model theory of various new classes of theories and has already born fruit in other branches of mathematics. However, the classical tools of stability theory have limited applicability outside the stable context. Thus, new tools and ideas are needed.

An original idea of Newelski was an application of the "language" of topological dynamics (i.e. the theory which investigates dynamical systems in a context and from the point of view of general topology). This allows to describe new interesting phenomena concerning various model-theoretic objects which lead to non-trivial results and questions in a very general setting.

This project aims at an extensive development of the methods of topological dynamics in model theory, both in general and in more specific classes of structures. On the one hand, we plan to resolve various problems involving notions of topological dynamics already present in model theory, and, on the other hand, we plan to bring to model theory some more sophisticated tools of topological dynamics such as entropy theory. We expect that our research will have a fundamental impact on further developments in model theory. We also plan to develop entropy theory in some situations (outside model theory), in which it has not been considered so far. Moreover, we plan to apply certain model-theoretic techniques to get new results in group theory.