First Joint Meeting Brazil-France in Mathematics
Special Session on Mathematical Logic

Organisers:
Boban Velickovic (Université Paris-Diderot, France)
Samuel Gomes da Silva (Universidade Federal da Bahia, Brazil)
Elaine Pimentel (Universidade Federal do Rio Grande do Norte, Brazil)

The special session on Mathematical Logic in the 1st Joint Meeting Brazil-France (2019) aims at enforcing already existing collaborations, establishing new ones, and giving the opportunity to interact with colleagues of other areas and of both countries at the same time. This is the third special session on Mathematical Logic organised by IMPA/SBM, after the successful ones: 1st Joint Meeting Brazil-Spain in Mathematics (2015) and 1st Joint Meeting Brazil-Italy (2017).

The scientific content may be briefly resumed by listing the three main topics: Set, Model and Proof Theories.

There are several bridges connecting Set Theory and Model Theory with other fields of Mathematics. For example, on the one hand there are by now several applications of deep results in Infinite Combinatorics and Set Theory to Functional Analysis and operator algebras, in particular in the study of the non-separable spaces. On the other hand, Descriptive Set Theory and Ramsey theoretic methods are powerful tools to investigate several problems arising in topological dynamics and/or in the study of classification problems for certain mathematical structures (e.g.: classification of ergodic measure preserving transformations, classification of separable Banach spaces up to isomorphism, etc.).

Interactions of Model Theory with other parts of Mathematics can be traced back to Tarski's quantifier elimination for the complex and real fields in the late 1930s. In more recent years o-minimality has been applied to real analysis, and real analytic and algebraic geometry. The deep work of Pila and Wilkie on rational heights has shown striking links between o-minimality and diophantine geometry. Techniques from pure Model Theory have also been very much employed for studying mathematical structures. The innovative ideas of Zilber in Zariski geometries have suggested a new approach to the understanding of complex exponentiation. Model theoretic tools have been applied also to the theory of modules and Lie groups and have given many interesting results. It is also worth noticing the successful model theoretic approach on the theory of quadratic forms (and special groups) which have been establish over the past 25 years through the collaboration of Francisco Miraglia (USP, Brazil) and Max Dickmann (Paris-Diderot, France).

The forth pillar of Mathematical Logic (alongside Model Theory, Set Theory, and Recursion Theory) is Proof Theory. Modern Proof Theory was established by David Hilbert early in the 20th century, in order to prove the consistency of the ordinary methods of reasoning used in mathematics – in arithmetic (number theory), analysis and set theory. Already in his famous "Mathematical problems" of 1900 he raised, as the second problem, that of proving the consistency of the arithmetic of the real numbers. Since Proof Theory has proofs as formal mathematical objects, their analysis is facilitated by mathematical techniques. This allows for not only using computer programs for proving theorems automatically or checking mathematical proofs (automatic theorem proving/checking), but also for extracting algorithms from proofs so that to construct examples for valid theorems or counter-examples from failed proof-search. Some more abstract consequences are understanding which axioms are required to prove which theorems (reverse mathematics), as well as comparing different proof methods and in particular the sizes of the proofs they output (proof complexity). This is a flourishing research direction, which makes the bridge between pure Mathematics and Theoretical Computer Science.

List of confirmed speakers:

Juliana Bueno-Soler (UNICAMP - Brazil)
Walter Carnielli (UNICAMP - Brazil)
Giles Dowek (ENS Paris-Saclay - France)
Jean-Baptiste Joinet (Université Jean Moulin - Lyon, France)
Alexandre Miquel (ENS de Lyon - France)
Valeria de Paiva (PUC-Rio - Brazil)
Elaine Pimentel (UFRN - Brazil)
Boban Velickovic (Université Paris 7 - France)
Christina Brech (USP - Brazil)
Max Dickmann (Université Paris Diderot - France)
Hermann Haeusler (PUC-Rio - Brazil)
Hugo Mariano (USP - Brazil)
Francisco Miraglia (USP - Brazil)
Luiz Carlos Pereira (PUC-Rio, UERJ - Brazil)
Samuel Gomes da Silva (UFBA - Brazil)
Giorgio Venturi (UNICAMP - Brazil)