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**UNIVERSITÄT
BERN**

Philosophisch-
naturwissenschaftliche Fakultät

Departement Mathematik und Statistik

Mathematisches Institut

Mathematical Colloquia

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Monday, 29 April 2024

17:15 h, lecture room B6 (ExWi)

Prof. Dr. Carles Noguera, University of Siena

Characterizations of (identity-free) first-order logic as a maximally expressive language

Abstract : In the 1960s, Per Lindström showed that first-order logic is maximal (in terms of expressive power) among its extensions satisfying certain combinations of model-theoretic properties. The best known of these combinations are: (i) Löwenheim-Skolem theorem + Compactness and (ii) Löwenheim-Skolem theorem + Recursively enumerable set of validities. Philosophically, these results have been interpreted as providing a case for first-order logic being the ``right" logic in contrast to higher-order, infinitary, or logics with generalized quantifiers, which can be argued to be more mathematical beasts. An implicit assumption of Lindström's work is that identity belongs in the base logic. The classical Lindström theorems clearly fail for first-order logic without identity since first-order logic with identity is a proper extension. In fact, there are continuum-many logics between the former and the latter satisfying the compactness and Löwenheim-Skolem properties, and with recursively enumerable sets of validities. After going through the motivation and the main history of the topic, in this talk we will present our recent result that aims at amending Lindström's two central theorems so that they apply in the identity-free context. Our proofs make heavy use of a property that is not available in the presence of identity, namely, an unrestricted upwards Löwenheim-Skolem theorem that applies even to finite models.