Logikseminar (MSc) WiSe 2021 **Prof. Dr. Martin Otto**

Classical Methods & Non-Classical Variations in Model Theory

Classical model theory is the model theory of first-order logic for (typically infinite) first-order structures. When special types of structures (e.g. just finite structures, other non-elementary classes of structrures, many-sorted structures with access to higher-order features) and/or extensions and variations of first-order logic and its classical semantics are concerned, many assests of classical model theory – and most notably the compactness theorem – are no longer available. In some intermediate scenarios of interest, however, one can find specific adaptations of classical first-order methods. e.g. with so-called weak models (serving as approximations for higher-order features), interpretations in amenable standard structures (whose model-theory can be developed beyond first-order logic), or specific constructions of (finite) models that are more combinatorial in nature.

In this seminar we want to deal with some examples of the above kinds of techniques that go beyond the established realm of traditional classical model theory in the above sense. Primary, though not necessarily exclusive focus can be on the modelling of the semantics of logics that aim for reasoning about knowledge and information, like extensions of modal logics or logics with team semantics. Some indications of related approaches and potential topics can be found among the references listed below.

For further planning of the seminar, I would ask prospective participants to contact me directly: `otto@mathematik.tu-darmstadt.de`

References

[1] A. Dawar and M. Otto. Modal characterisation theorems over special classes of frames. Annals of Pure and Applied Logic, 161, 2009, pp. 1-42.

[2] P. Dittmann. Ultraproducts as a tool for first-order inexpressibility in the finite and infinite. Preprint 2013, arXiv:1310.3137

[3] E. Grädel and M. Otto. The freedoms of (guarded) bisimulation. In: Johan van Benthem on Logic and Information Dynamics, A. Baltag, S. Smets (eds), Springer 2014, pp. 3-31.

[4] S. Lindell, H. Towsner and S. Weinstein. Infinitary methods in finite model theory. In: Logic Without Borders, Hirvonen, Kontinen, Kossak, Villaveces (eds), De Gruyter, 2015. https://doi.org/10.1515/9781614516873.305

[5] S. Meißner and M. Otto. First-order framework for inquisitive modal logic. *Review of Symbolic Logic*, 2021. To appear, 23 pages, arxiv:1906.04981.

[6] A. Tsuboi. Nonstandard methods for finite structures. Mathematical Logic Quarterly, 66, 2020, pp. 367-372. https://doi.org/10.1002/malq.202000024

[7] J. Väänänen. Pseudo-finite model theory. Mat. Contemp., 24, 2003, pp. 169-183.