TOPICS IN ALGEBRAIC TOPOLOGY

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My research interests are in algebraic topology and its interactions with commutative algebra, differential topology, and homological algebra. Currently, I am focusing on applications of rational homotopy theory and algebraic operads to the homotopy theory of manifolds, especially the study of spaces of automorphisms of manifolds and characteristic classes for fibrations. To get an idea of what this is about, you can have a look at some of my recent papers, in particular [3, 4, 6]. Some lectures notes that discuss relevant background material are [1, 2, 5].

My current research draws on methods from several areas of mathematics. I list some keywords below. Interest in at least one these could serve as an entry point to a PhD project supervised by me.

- Algebraic topology (cohomology and homotopy groups, homotopical algebra, rational homotopy theory, homotopy theory of manifolds)
- Commutative algebra (Gorenstein rings, Koszul complexes, free resolutions)
- Differential topology (diffeomorphism groups, fiber bundles, characteristic classes)
- Homological algebra (group cohomology, Hochschild and cyclic homology, Koszul duality, differential graded algebras)
- Operads and higher structures (A_∞-algebras, L_∞-algebras, cyclic and modular operads, graph complexes)

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References

[1] Alexander Berglund, *Rational homotopy theory*. Lecture notes.
Available here: `https://staff.math.su.se/alexb/rathom2.pdf`

[2] Alexander Berglund, *E_∞-algebras and Mandell's theorem*. Lecture notes.
Available here: `https://staff.math.su.se/alexb/Eoo_2016-08-10.pdf`

[3] Alexander Berglund, *Characteristic classes for families of bundles*. Selecta Math. (N.S.) **28** (2022), Paper No.51, 56 pp.

[4] Alexander Berglund and Ib Madsen, *Rational homotopy theory of automorphisms of manifolds*. Acta Math. **224** (2020), no. 1, 67–185.

[5] Alexander Berglund and Robin Stoll, *Higher structures in rational homotopy theory*. `arXiv:2310.11824 [math.AT]`. Book chapter to appear in *Higher Structures and Operadic Calculus*, Advanced Courses in Mathematics – CRM Barcelona, Springer.

[6] Alexander Berglund and Tomasz Zeman, *Algebraic models for classifying spaces of fibrations*. `arXiv:2203.02462 [math.AT]`. To appear in Geometry & Topology.