MAT-8805: TOPICS IN PARABOLIC GEOMETRIES (PHD COURSE, 5 CREDITS – WINTER 2020)

Description: There many differential geometric structures not falling into the paradygm of Riemannian geometry that are well-motivated by applications in physics, astronomy, control theory, etc. This course focuses on conformal and projective geometries, which are two prototypical examples of the vast class of parabolic geometry. While in Riemannian geometry, one primarily focuses on the notions of metrics, distances and the derived structures, conformal geometry is the geometry of angles, and projective geometry is the geometry of (unparametrized) geodesics. Important questions such as the construction of invariants/covariants and natural linear differential operators will be addressed, and perspectives via Cartan geometry and tractor calculus will be explored.

Admission requirements: Master of science degree in mathematics or equal. Prerequisites include exposure to advanced differential geometry topics such as connections and curvature on vector bundles and principal bundles, as well as the theory of Lie groups and Lie algebras.

Main references:

- S. Curry, A.R. Gover, *An Introduction to Conformal Geometry and Tractor Calculus with a view to Applications in General Relativity*, arXiv:1412.7559 (2015).
- M. Eastwood, *Notes on Projective Differential Geometry*, Symmetries and Overdetermined Systems of Partial Differential Equations (2008) pp 41-60;
- M. Eastwood, V. Matveev, *Metric Connections in Projective Differential Geometry*, Symmetries and Overdetermined Systems of Partial Differential Equations (2008) pp 339-350;

  both articles available via UiT at link.springer.com/book/10.1007/978-0-387-73831-4.

Course coordinators:

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Coursework:

- Students are required to give presentations based on suggested exercises. A passing grade is required for permission to take the final exam.

Final Exam:

- The (oral) final exam counts for 100% of the grade and this will be assigned Pass or Fail.

Date: March 5, 2020.