

Master thesis - PDE's in General Relativity

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My main field of research is *Partial Differential Equations in General Relativity* with particular applications to the initial value problem for the Einstein equations. This area of Mathematical Relativity is concerned with the study of solutions to the Einstein equations by their initial value formulation. Such as for other geometric flows the Einstein-equations describe evolving geometric structures on spacelike hypersurfaces. We foliate a spacetime by spacelike hypersurfaces which carry a metric and further geometric quantities. The evolution of these quantities moving through the leaves of the foliation (moving in future or past direction of the spacetime) is given by the Einstein equations.

In this formulation, the Einstein equations read as a coupled system of partial differential equations of different types. A mathematical analysis involving several techniques from the theory of partial differential equations allows us to deduce rigorous results about the behaviour of solutions to the Einstein equations - such as global existence, nonlinear stability results or asymptotic behaviour.

This area also offers a number of problems suitable for a master thesis. In any case, students should be interested in a rigorous (mathematical) study of Einstein equations and the relevant mathematical topics. As a guideline the books by Rendall (*PDE's in General Relativity* - Oxford) and Ringström (*The Cauchy Problem in General Relativity* - Lectures in Mathematics and Physics) give excellent overviews on the field. I encourage students interested in a master thesis to contact me for more detailed informations via *David.Fajman@univie.ac.at*.