Tutorial Sessions:
ASQG meets computer tensor algebra

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Goal of the tutorial sessions

The goal of these tutorial sessions is to provide a practical introduction to functional renormalization group methods applied to the program of asymptotically safe quantum gravity. We will present an overview of the mathematical tools and approximation schemes that one can use to extract beta functions in quantum gravity. After this introduction, we will discuss the computational tools that one can use to automatize calculations based on functional renormalization group methods. In particular, we will focus on tools based on the software *Mathematica* combined with the *xAct*-suite, which is dedicated to tensor manipulations.

Guidelines before the tutorial sessions

Aiming to maximize the use of these tutorial sessions, we recommend that the participants bring their own laptops. In this case, we ask the participants:

- to have *Mathamatica* installed with a working license.

- to install the *xAct*-suite (see: http://www.xact.es/).

    - xAct for Linux/Unix/Mac: click here
    - xAct for Windows: click here
    - See also the installations notes for *xAct*.

Due to limited time, we will not be able to cover the basics of *Mathematica* during the tutorial sessions. If you feel that you need to brush up your *Mathematica* skills before the tutorial sessions, we recommend a series of lectures by Pedro Vieira available on the webpage of Perimeter Institute:

- Lect 1: part 1; part 2

- Lect 2: part 1; part 2

- Lect 3: part 1; part 2

Plan of the tutorial sessions

- Day 1 – Overview of the Functional Renormalization Group and its application to Asymptotically Safe Quantum Gravity.

- Day 2 – Tensor algebra with *Mathematica*: Introduction to the *xAct*-suite.

- Day 3 – Asymptotic Safety calculations with *Mathematica*: The Einstein-Hilbert truncation in the background field approximation.