Computer algebra for special functions
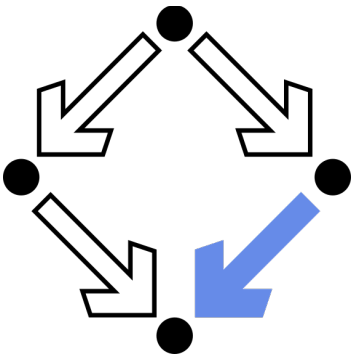
Nikolai Fadeev

Institute: **RISC/RISC Software GmbH**

Advisor: **Prof. Dr. Carsten Schneider**

Academic background

- 2013-2016: Three years of CPGE (*Higher School Preparatory Classes*), with Mathematics and Physics specialization (MPSI/MP).

CPGE: Alternative to university, very intensive lectures that prepare students for competitive exams in order to enroll in French *grandes écoles* (e.g. engineering schools such as *Ecole Polytechnique, Ecole Centrale, Ecole des Mines...*). Material studied:

  - Two scientific subjects : Mathematics/Physics, Physics/Chemistry,... **}** 80%
  - Computer science + Engineering
  - Languages **}** 20%
  - Literature

Academic background

- 2016-2019: *Magister of Fundamental Physics* of Paris-Sud 11 University

  - 2016-2017: **3rd year of Bachelor** + Internship:
    Parametric amplification in cosmology (Prof. Renaud Parentani — LPT Orsay)

  - 2017-2018: **1st year of Master** in Heidelberg (ERASMUS) + Internship:
    A critical study of antigravity (Prof. Pierre Vanhove — IPhT CEA Saclay)

  - 2018-2019: **2nd year of Master** in the *International Center for Fundamental Physics* (ICFP) at *Ecole Normale Supérieure* (ENS), specialization in theoretical physics + Internship:
    Holographic renormalization flows for confining theories in curved spacetime (Prof. Elias Kiritsis – APC Paris Diderot University)

Work at RISC

- Learning the basics of *difference field and difference ring theory*: machinery allowing for representation of nested sums in a form manageable for the computer and calculation of their closed form.

- Lectures:
  - Algebraic combinatorics — enumerating finite sets and graphs (Polya action, group theory)
  - Computer algebra — GCD algorithms, solving formally polynomial systems of equations (Gröbner basis)
  - Special functions — elliptic functions, modular forms,…

SAGEX Network

- Collaborations with many renown institutions throughout Europe: seminars, meetings, workshops

- Opportunites to do internships (Wolfram Research, DESY,…): learn most state-of-the-art techniques and use it in my work

- Possibility to work on the purely mathematical aspect of amplitudes (nested integrals/sums) and apply new computational techniques to problems in particles physics studied in SAGEX network

Thank you for listening!