ENERGY FORMS ON FRACTALS

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There are several approaches in order to define energy forms on a fractal. One of the most popular ones - based on simple calculus - is due to Jun Kigami. However, his monograph (Analysis on fractals, 2001) presents the ideas in a very formal, general language and on a high level of mathematical sophistication. Hence, it might be hardly accessible for beginners. The book of Strichartz [2] is called "a soft introduction" to the subject (by the author himself).
In Chapter 1 of Strichartz' book, energy forms on fractals are obtained as limits of discrete graph energies. To this end, self similar (finitely ramified) fractals are approximated by sequences of finite graphs. On these graphs, we have the notion of graph energies (known from the Internet Seminar, see [1]). Now the challenge is to find the right renormalization to make these sequences of graph energies convergent. Then the limit is an energy form on the fractal! In Chapter 1 of [2], these ideas are developed very detailed with the help of the two model cases *unit interval* and *Sierpinski Gasket*.

This project is suited for 3 to 4 students.

References

[1] ISem 26, Lecture Notes, 2023. `https://www.mat.tuhh.de/veranstaltungen/isem26/_media/lecturenotes.pdf`
[2] R. S. Strichartz: *Differential Equations on Fractals. A Tutorial.* Princeton University Press, Princeton, 2006