Abstract of the introductory talk by Keshav Aggarwal: Modular forms and Spectral analysis: Motivation and Introduction. Much of modern number theory involves the study of modular forms and their L-functions. We will motivate the definition of modular forms through examples and explore their connections with other mathematical objects like the Riemann zeta function. We will then give an outline of their study using spectral decomposition of hyperbolic Laplace operator. This will be an introduction for Némethi András's talk, who will explain some of the geometrical and topological meaning of the cohomology of those cubical complexes.

Abstract of the main lecture by Valentin Blomer: Applications of the relative trace formula. A relative trace formula is a certain weighted summation formula that compares spectral and geometric properties of a locally symmetric space. This turns out to be a tremendously useful tool at the interface of analytic number theory and automorphic forms. I will explain the relative trace formula in simple cases and show a large number of rather diverse applications in number theory and spectral geometry.