Dr. Urs Niesen will analyze the asymptotic behavior of compute-and-forward relay networks in the regime of high signal-to-noise ratios. He will consider a section of such a network consisting of K transmitters and K relays. The aim of the relays is to reliably decode an invertible function of the messages sent by the transmitters. An upper bound on the capacity of this system can be obtained by allowing full cooperation among the transmitters and among the relays, which will transform the network into a K*K multiple-input multiple-output (MIMO) channel. The number of degrees of freedom of compute-and-forward is hence at most K.

He will then analyze the degrees of freedom achieved by the lattice coding implementation of compute-and-forward proposed recently by Nazer and Gastpar. He will show that this lattice implementation achieves at most 2/(1+1/K) ≤ 2 degrees of freedom, thus exhibiting a very different asymptotic behavior than the MIMO upper bound. This raises the question if this gap of the lattice implementation to the MIMO upper bound is inherent to compute-and-forward in general. He will answer this question to the negative by proposing a novel compute-and-forward implementation achieving K degrees of freedom.