Jérémie Unterberger (Nancy):

The scaling limit of the KPZ equation in space dimension 3 and higher.

We consider in this talk the Kardar-Parisi-Zhang (KPZ) equation

$$\partial_t h(t,x) = \nu\Delta h(t,x) + \lambda|\nabla h(t,x)|^2 + \sqrt{D}\,\eta(t,x), \qquad (t,x) \in R_+ \times R^d$$

in $d \geq 3$ dimensions in the perturbative regime, i.e. for $\lambda > 0$ small enough and a smooth, bounded, integrable initial condition $h_0 = h(t=0,\cdot)$. The forcing term η in the right-hand side is a regularized space-time white noise. The exponential of h – its so-called Cole- Hopf transform – is known to satisfy a linear PDE with multiplicative noise. We prove a large-scale diffusive limit for the solution, in particular a time-integrated heat-kernel behavior for the covariance in a parabolic scaling.

The proof is based on a rigorous implementation of K. Wilson's renormalization group scheme. A double cluster/momentum-decoupling expansion allows for perturbative estimates of the bare resolvent of the Cole-Hopf linear PDE in the small-field region where the noise is not too large, following the broad lines of Iagolnitzer-Magnen. Standard large deviation estimates for η make it possible to extend the above estimates to the large-field region. Finally, we show, by resumming all the by-products of the expansion, that the solution h may be written in the large-scale limit (after a suitable Galilei transformation) as a small perturbation of the solution of the underlying linear Edwards-Wilkinson model ($\lambda = 0$) with renormalized coefficients $\nu_{eff} = \nu + O(\lambda^2), D_{eff} = D + O(\lambda^2)$.