

# Nonparametric drift estimation for linear SPDEs from local measurements

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**Abstract:** We study the problem of nonparametric estimation in a linear second order stochastic partial differential equation (SPDE). For this a new observation scheme is introduced: The solution is observed continuously in time, but spatially localised with respect to a test function. This describes locally averaged measurements, for instance of quantities such as heat or concentration of some substance. For the asymptotic regime with fixed time horizon and with the spatial localisation tending to zero, we provide rate-optimal estimators for the coefficients of the underlying differential operator. This is statistically remarkable: While it is well-known that consistent drift estimation for stochastic ordinary differential equations is possible for large time asymptotics, small noise levels or independent observations, here we show that shrinking spatial localisation already yields consistency. What is more, even in the nonparametric setup with spatially varying coefficients, the parametric rate is achieved and central limit theorems can be proved. The parametric rate is optimal, for which we provide a lower bound.

## References

- [1] R. Altmeyer and M. Reiß (2019). Nonparametric drift estimation for linear SPDEs from local measurements. *arXiv preprint*, arXiv:1903.06984.