AR (1) processes driven by second-chaos white noise: precise speed of convergence results for parameter estimation using analysis on Wiener space.

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In the limit of high-frequency data for time series, also known as infill asymptotics, most mean-reverting processes are well-approximated by a classical un-centered Ornstein-Uhlenbeck processs with Gaussian noise. This is not a good approximation, however, for processes with discrete observation, particularly for fixed-scale observation inter-arrival time. The asymptotics in this case are of the so-called increasing horizon type, and any process with non-normal noise will retain features which stem from the non-normality in any limit. In this talk, we describe the asymptotic behavior of the quadratic variation for the class of AR(1) processes driven by white noise in the second Wiener chaos. This class of distributions, whose tails are roughly exponential, is far more flexible than Gaussian noise, because a free infinite-dimensional parameter remains after standardization. We will explain this phenomenon using a series representation of the second Wiener chaos. New tools from the analysis on Wiener space are established to provide an efficient convergence rate in total variation distance. The now-classical optimal 4th moment theorem of Nourdin and Peccati, and its 3rd-moment interpretation established by the presenter and Neufcourt, cannot apply to our setting which involves a convolution of 4th and 2nd chaos terms. We give an upper bound for the total-variation speed of convergence of the process's quadratic variation to the normal law, which we apply to study the estimation of the model's mean-reversion parameter.

This is joint work with Soukaina Douissi (Africa Business School, Marrakech, Morocco), Khalifa Es-Sebaiy (University of Kuwait), Fatimah Alshahrani (Princess Nora bint Abdulrahman University, Riyadh, Saudi Arabia), and is in press at Stochastic Processes and their Applications. .