

# Michigan Tech

**Mathematical Sciences Colloquium**

**Michigan Technological University**

**Friday, March 20, 2015**

**1:05 p.m.**

**Fisher Hall 101**

---

**Quantile-Based Spectral Analysis of Time Series**

**Tobias Kley**

**Ruhr University Bochum**

In this talk an alternative approach to the spectral analysis of time series is presented. First, a “new” spectrum is defined for stationary processes  $\{Y_t\}_{t \in \mathbb{Z}}$ . We call the Fourier transform of the differences between copulas of the pairs  $(Y_t, Y_{t-k})$  and the independence copula the *copula spectral density kernel*. This object allows to separate marginal and serial aspects of a time series. The copula intrinsically provides more information about the conditional distribution than the covariance. Thus, the copula spectral density kernel is more informative than the spectral density obtained from the autocovariances. In particular, a complete description of the distributions of all pairs  $(Y_t, Y_{t-k})$  is possible. A rank-based estimator of the copula spectral density kernel is provided. Its asymptotic properties are established. The results are applicable without restrictive distributional assumptions such as the existence of finite moments and only weak mixing assumptions are necessary. The R package *quantspec* will be introduced. A demonstration on how it can be used in the analysis of an empirical example will be given. This is joint work with H. Dette, M. Hallin, and S. Volgushev.

Kley, T., Volgushev, S., Dette, H. and Hallin, M. (2015+). Quantile spectral processes: Asymptotic analysis and inference. To appear in *Bernoulli*.

Kley, T. (2015+). Quantile-based spectral analysis in an object-oriented framework and a reference implementation in R: The *quantspec* Package. To appear in the *Journal of Statistical Software*.