

Institut für Geophysik
Geophysikalisches Kolloquium
Wintersemester 2025/2026

Montag, 17.11.2025

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Geological Survey of Denmark and Greenland (GEUS)

**From quasicrystals to seismic arrays: the power of aperiodicity to
sample the seismic wavefield**

Finding optimal wave sampling methods has far-reaching implications in wave physics, such as seismology, acoustics, and telecommunications. A key challenge is surpassing the Whittaker-Nyquist-Shannon (WNS) aliasing limit, establishing a frequency below which the signal cannot be faithfully reconstructed. However, the WNS limit applies only to periodic sampling, opening the door to bypassing aliasing by aperiodic sampling. In this work, we investigate the efficiency of a recently discovered family of aperiodic monotile tilings, the hat family, in overcoming the aliasing limit spatially sampling a wave field. By analyzing their spectral properties, we show that aperiodic monotile seismic (AMS) arrays, based on a subset of the hat tiling family, efficiently surpass the WNS sampling limit. Our investigation leads us to propose AMS arrays as a design principle for seismic arrays. We show that AMS arrays can outperform regular and other aperiodic arrays in realistic beamforming scenarios using single and distributed sources, including station-position noise and station failures. While current seismic arrays optimize beamforming or imaging applications using spiral or regular arrays, AMS arrays can accommodate both, as they share properties with both periodic and aperiodic arrays. More generally, our work suggests that aperiodic monotiles can be an efficient design principle in various fields requiring wave sampling.

Das Kolloquium findet um 11:15 Uhr im Seminarraum GEO 315, Corrensstr. 24, 48149 Münster statt. Alle an dem Thema Interessierten sind hierzu herzlich eingeladen.

Die Dozenten des Instituts für Geophysik