

Seminar of the Work Group  
Nonlinear Partial Differential Equations  
SS 22

**Speaker: Dr. Florian Feppon**  
**July 12th, 2022, 14:00 - 15:00**  
**Zoom Link: <https://kit-lecture.zoom.us/j/5732649920>**  
**Meeting ID: 573 264 9920**

Signal amplification and compression in ultra fast time modulated metamaterials  
due to a space-time resonant coupling

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**Abstract**

We propose a mathematical analysis of acoustic wave scattering due to a time modulated highly contrasted inclusion. The density of the inclusion is periodically modulated at a frequency which is much larger than the incident frequency, whence the denomination of “ultra fast” modulation. In most scenarios, we find that the effect of the fast time modulation is averaged over time and everything occurs as if the medium had a unmodulated effective density. However, when the modulation is finely tuned, a strong coupling between the inclusion and the incident wave arises: we show that the scattered wave carries high frequency components (oscillating at the frequency of the modulation), and upon explicit conditions on the modulation, we find the existence of exponentially growing outgoing modes, which suggests that such device could serve as an amplifier. Our analysis relies on a novel approach for the understanding of subwavelength resonance, which is based on the rewriting of the scattering problem in terms of the Dirichlet-to-Neumann operator.