

The acoustic Borrmann effect: Anomalous transmission through periodic resistive sheets

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We consider the scattering of acoustic waves on a set of equidistant resistive sheets. We show theoretically and experimentally that at the Bragg frequency, the transmission presents an anomalously high peak. Moreover, the peak can be made arbitrarily narrow by increasing the number of sheets. Using the transfer matrix formalism, it is shown that this effect occurs when the two eigenvalues of the transfer matrix coalesce, i.e. at an exceptional point.

We verify experimentally this effect by sending acoustic waves inside a waveguide with resistive sheets placed equidistantly. The setup and main results are shown in Fig. 1.

Exploiting the exceptional point condition, we also discuss how we can obtain similar anomalous transmission peaks in more general periodic media. In particular, the system can be tuned to show a peak while having a subwavelength size.

References

- [1] A. Coutant, Y. Aurégan, and V. Pagneux, “Anomalous transmission through periodic resistive sheets,” *Journal of the Acoustical Society of America* **147** no. 5, 3124-3135 (2020). [arXiv:2001.00824](https://arxiv.org/abs/2001.00824) [physics.class-ph].

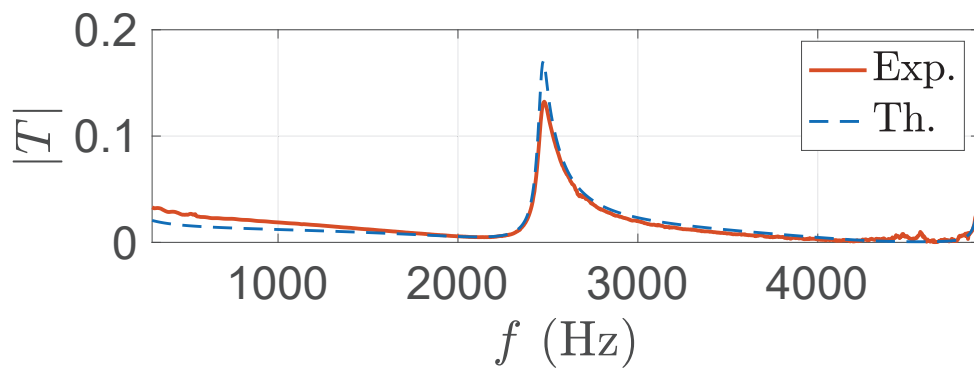
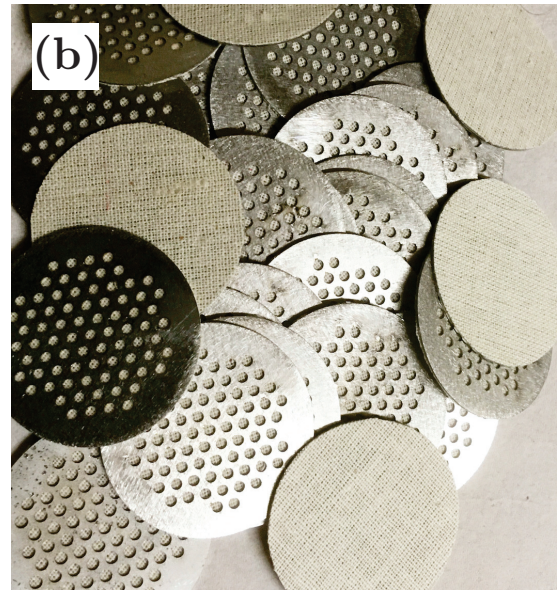
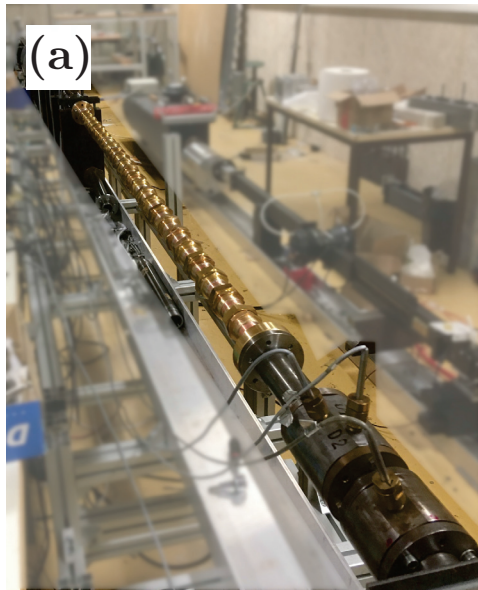


Figure 1: (a) Experimental setup made of a tube of radius 3cm, a speaker and two microphone at each ends. (b) Resistive sheets made of fine meshed fabric attached to a rigid metallic grid. (c) Transmission coefficient as a function of the frequency; experimental results and theoretical model.