Appendix A.

Detailed dimensions of one metasurface subunit

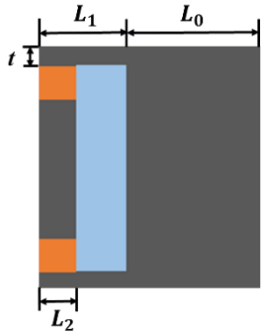

Figure S1. Detail dimensions of one metasurface subunit with the following parameters: t=0.05m, L_0=0.4m, L_1=0.24m and L_2=0.1m.

Appendix B.

Resonance mode shape around 300Hz, displacement magnitude and energy flux at 300Hz of the side with rubber and plate

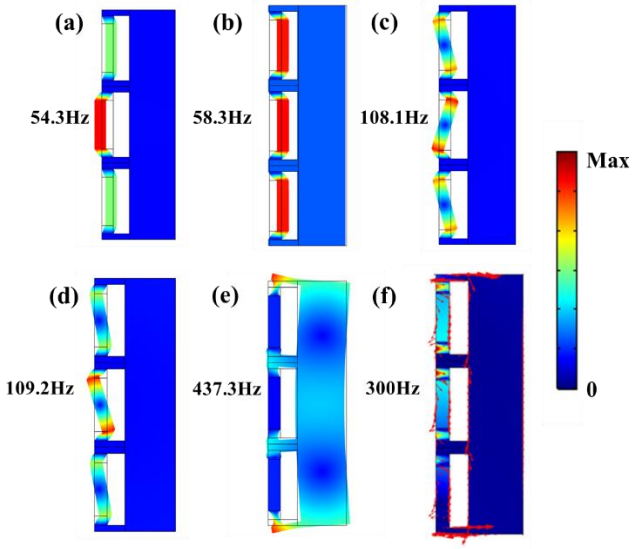

Figure S2. (a-e) Resonance mode shape around 300Hz, (f) displacement magnitude(color) and energy flux(red arrow) at 300Hz.

Appendix C.

Asymmetric transmission with lossless metasurface

Asymmetric transmission when the rubber is lossless is also investigated. We sweep the parameter *r* and establish another interpolated function of phase shift assuming the Young's modulus of the rubber is 50MPa. Normalized total acoustic pressure field under a wave with the incident angle equal to $\pm 30^{o}$is displayed in Fig.8. We can see when the incident angle is 30^{o}, there is still some nonnegligible transmitted wave, which is not as clean as the loss case in Fig.2b.

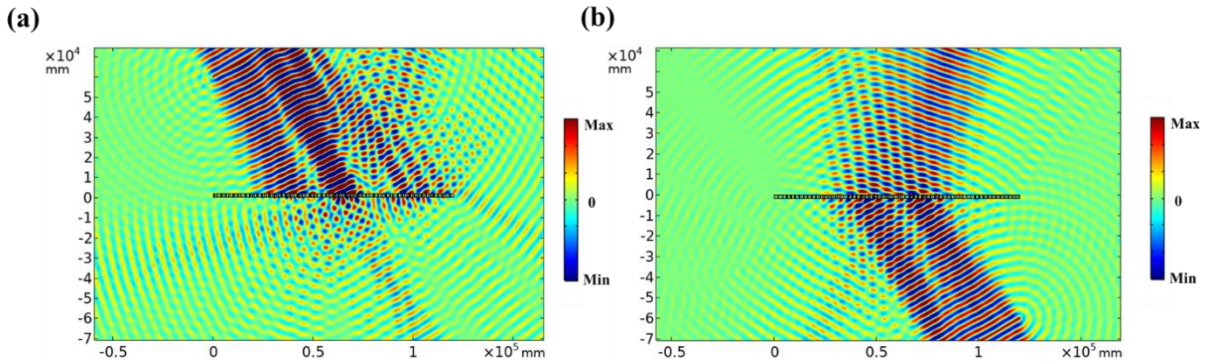

Figure S3. (a) Normalized total acoustic pressure field under a wave with the incident angle equal to 30^{o}, and (b) normalized total acoustic pressure field under a wave with the incident angle equal to -30^{o}. The rubber is modeled with no loss effect.