PhD Position within the MSCA Doctoral Network ABHSSYS.

ABHSSYS (Acoustic Black Holes for Silent SYStems, Grant agreement ID: 101227712) is a European Doctoral Network funded by the Marie Skłodowska-Curie Actions (MSCA), dedicated to advancing innovative solutions for vibration and noise control in lightweight structures (https://cordis.europa.eu/project/id/101227712). The project focuses on the development of Acoustic Black Hole (ABH) technologies, an emerging concept that enables efficient damping of vibrations and sound while reducing mass and material use. Bringing together leading academic laboratories and industrial partners across Europe, ABHSSYS will train a new generation of researchers at the interface of wave physics, acoustics and engineering. Through interdisciplinary research, international mobility and close collaboration with industry, the program aims to accelerate the transfer of ABH technologies towards real-world applications in sectors such as aerospace and energy.

Application Deadline: August 23rd 2026 - **Expected starting date:** November 2026

Acoustic insulation of lightweight partitions combining structural and aerial Acoustic Black Holes

Description: Lightweight panels inherently suffer from two major limitations: poor low-frequency insulation and a loss of performance around the coincidence frequency. Overcoming these limitations without increasing mass or thickness remains a major scientific and technological challenge. Acoustic Black Hole (ABH) concepts offer a promising approach to address this issue. In both solids and fluids, ABHs rely on a common principle: a progressive reduction of wave velocity concentrates energy in space, enabling its efficient dissipation through intrinsic or added loss mechanisms.

This project proposes to combine this same physical principle across two distinct domains. Structural ABHs act in a solid layer through thickness gradients, while aerial ABHs act in an acoustic layer through spatial gradients. In both cases, slowing down waves leads to energy concentration and localized dissipation. While both approaches have been studied independently, their combination within a single system remains largely unexplored.

The objective of this PhD is to design and validate a new class of acoustic partitions based on a double-layer concept, combining a structural ABH layer (solid domain) and an aerial ABH layer (acoustic domain). The originality of the approach lies in applying the same wave control principle to two different physical media, and in exploiting their coupling to overcome the limitations of single-panel partitions. The work will involve analytical and numerical modeling of wave propagation and transmission, the design of hybrid ABH architectures, and the optimization of their spatial distribution. Prototypes will be manufactured and experimentally validated.

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Applications will be explored in aeronautics during a secondment at AIRBUS, including aircraft interior structures such as walls, ceilings or partitions, with potential applications in other fields requiring compact and efficient acoustic insulation.
The candidate should have a strong background in acoustics, mechanics or physics, with an interest in both modeling and experimental work, and a strong motivation for applied research and prototype development.

[1] F. Gautier and A. Pelat. Broadband vibration mitigation using a two-dimensional acoustic black hole phononic crystal. The Journal of the Acoustical Society of America, 155(5):3051–3059, 2024.

[2] T. Bravo and C. Maury. Broadband sound attenuation and absorption by duct silencers based on the acoustic black hole effect: Simulations and experiments. Journal of Sound and Vibration, 561:117825, 2023.

Hosting institution: Le Mans, located less than one hour from Paris by train, offers a high quality of life with a balanced environment combining accessibility, affordability, and a strong acoustic ecosystem. It provides an ideal setting for focused research while remaining closely connected to major academic and industrial hubs.
As a PhD candidate, you will be fully recruited by Metacoustic, an innovation-driven SME specialized in acoustics, located near the train station and close to the city center. Metacoustic is a small and agile team of around ten people, working at the interface between research and industry, with strong expertise in acoustic measurements, numerical simulation, and metamaterials.
Your research will be conducted in a joint environment between Metacoustic and the Laboratoire d'Acoustique de l'Université du Mans (LAUM), offering a balanced exposure to industrial R&D and academic research. You will benefit from complementary expertise and access to advanced experimental and numerical facilities across both institutions.
You will be supervised by Adrien Pelat and François Gautier at the University and by Damien Lecoq in the company. You will also work with Leonardo Sanches from Airbus within the interdisciplinary and international framework of the doctoral network.

The PhD diploma will be delivered by Le Mans Université.

Profile:
If you recognize yourself in the story below, then you have the profile that fits the project and the research group:

- I have a Master's degree in engineering, physics or mathematics and performed above average in comparison to my peers and I am not in possession of a doctoral degree at the date of recruitment (mandatory requirement)
- I haven't had residence or main activities (studies or working position, even remote) in France for more than 12 months in the last 3 years at the date of recruitment (mandatory requirement).
- During my courses or prior professional activities, I have gathered some basic experience with the physical principles of structural dynamics and (vibro-)acoustics and the related numerical modeling techniques, such as the Finite Element Method (FEM), as well as numerical optimization, manufacturing methods, and/or I have a profound interest in these topics. Experience and knowledge of metamaterials and passive control of sound and vibration is considered as a bonus.
- I am proficient in written and spoken English.
- I feel comfortable to work as a team member and I am eager to share my results to inspire and be inspired by my colleagues.

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- As a Doctoral Candidate I will perform research in a structured and scientifically sound manner. I will read technical papers, understand the nuances between different theories and implement and improve methodologies myself.
- Based on interactions and discussions with my supervisors and the colleagues in my team, I will set up and update a plan of approach for the upcoming 1 to 3 months to work towards my research goals. I will work with a sufficient degree of independence to follow my plan and achieve the goals. I will indicate timely when deviations of the plan are required, if goals cannot be met or if I want to discuss intermediate results or issues.
- In frequent reporting, varying between weekly to monthly, I will show the results that I have obtained and I will give a well-founded interpretation of those results. I will iterate on my work and my approach based on the feedback of my supervisors which steer the direction of my research.
- In the framework of the DN-ABHSSYS project, I will participate to the network training schools and I will present my research progress in front of the supervisory board every 6 months.
- During the course of my PhD, I will be hosted by the industrial partner involved in the thesis for a 6-month secondment in Airbus, Toulouse, France.
- During my PhD I want to grow towards following up the project that I am involved in and representing the research group on project meetings or conferences. I see these events as an occasion to disseminate my work to an audience of international experts and research colleagues, and to learn about the larger context of my research and the research project.

Offer:

◦ A remuneration package competitive with industry standards in France: you will receive a monthly gross salary of 3150€. In addition to the salary you will receive a mobility allowance of 475€ and, if applicable, a family allowance of 330€. The family allowance may be granted during your thesis if your circumstances change. The net income will be lower since a deduction of income tax, the social contributions, and other permitted deductions need to be considered.

◦ An opportunity to pursue a PhD in Acoustics, typically a 3-year trajectory, in a stimulating and ambitious research environment.

◦ Ample occasions to develop yourself in a scientific and/or an industrial direction with the European research group.

Recruiting procedure:

Each application will be evaluated by a jury of 5 members: Damien Lecoq, Adrien Pelat, François Gautier, Clément Lagarrigue, Julie Perchaud

2 selection rounds will be organized:
1/ A shortlist of candidates will be pre-selected based on eligibility criteria, CV and motivation letter.
2/ Selected candidates will be interviewed remotely.

Recruitment will be effective once all eligibility documents have been provided.

We look forward to receiving your application including a letter of motivation, CV, diplomas with transcripts and contact details of two referees on damien.lecoq@metacoustic.com.