

PhD scholarships bound to specific research topics/areas:

1 scholarship bound to a specific research topic:

Fast Parallel Hierarchical Matrix Solvers for Thermonuclear Energy Research (supervisor prof. Bruno Carpentieri)

Project description: This PhD project focuses on the development of fast parallel hierarchical matrix solvers to address computational challenges in thermonuclear energy research, with a specific emphasis on fusion power. Fusion energy promises a sustainable and uninterrupted power supply with no greenhouse gas emissions, making it a crucial component in mitigating climate change. The complex and multiphysics nature of fusion devices, including extreme conditions and intricate geometries, demands highly efficient computational techniques.

The project aims to advance our theoretical and practical understanding of solving large, dense linear systems, which arise from the discretization of integral equations in computational electromagnetics, fluid dynamics, and other energy-related applications. Traditional methods are computationally prohibitive for these problems due to their memory and algorithmic costs. We will develop novel matrix solvers based on hierarchical H-matrices, which offer a compact, accurate, and parallelizable representation of these equations. These advancements will significantly enhance the feasibility of large-scale simulations, making a substantial contribution to the design and optimization of future fusion power systems.