In Silico Pair Plasmas: from ultra intense lasers to relativistic astrophysics in the laboratory

Fact Sheet

Project Information

InPairs
Grant agreement ID: 695088
Project website
Status
Ongoing project
Start date
1 September 2016
End date
31 August 2021

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H2020-EU.1.1.
Overall budget
€ 1,951,123,50
EU contribution
€ 1,951,123,50

Hosted by
INSTITUTO SUPERIOR TECNICO
Portugal

Objective

How do extreme electromagnetic fields modify the dynamics of matter? Will quantum electrodynamics effects be important at the focus of an ultra intense laser? How are the magnetospheres of compact stellar remnants formed, and can we capture the physics of these environments in the laboratory? These are all longstanding questions with an overarching connection to extreme plasma physics. Electron-positron pair plasmas are pervasive in all these scenarios. Highly nonlinear phenomena such as QED processes, magnetogenesis, radiation, field dynamics in complex geometries, and particle acceleration, are all linked with the collective dynamics of pair plasmas through mechanisms that remain poorly understood. Building on our state-of-the-art models, on the availability of enormous computational power, and on our recent transformative discoveries on ab initio modelling of plasmas under extreme conditions, the time is ripe to answer these questions in silico. InPairs aims to understand the multidimensional dynamics of electron-positron plasmas under extreme laboratory and astrophysical fields, to determine the...
plasmas under extreme laboratory and astrophysical fields, to determine the signatures of the radiative processes on pair plasmas, and to identify the physics of the magnetospheres of compact stellar remnants, focusing on the electrodynamics of pulsars, that can be mimicked in laboratory experiments using ultra high intensity lasers and charged particle beams.

This proposal relies on massively parallel simulations to bridge the gap, for the first time, between the pair plasma creation mechanisms, the collective multidimensional microphysics, and their global dynamics in complex geometries associated with laboratory and astrophysical systems. Emphasis will be given to detectable signatures e.g. radiation and accelerated particles, with the ultimate goal of solving some of the central questions in extreme plasma physics, thus opening new connections between computational studies, laboratory experiments, and relativistic plasma astrophysics.

Field of science
/natural sciences/physical sciences/astronomy/astrophysics

Programme(s)

Topic(s)

Call for proposal

ERC-2015-AdG

Funding Scheme

ERC-ADG - Advanced Grant

Host institution

INSTITUTO SUPERIOR TECNICO

Address
Avenida Rovisco Pais 1
1049-001 Lisboa
Portugal

Activity type
Higher or Secondary Education Establishments

EU contribution
€ 1,951,123,50

Website
Contact the organisation
INSTITUTO SUPERIOR TECNICO

Portugal

EU contribution

€ 1 951 123,50

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1049-001 Lisboa

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