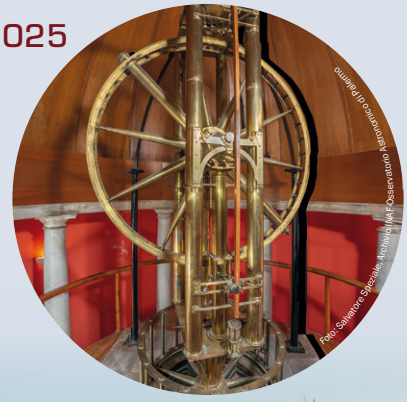
Società Italiana di Fisica

111° CONGRESSO NAZIONALE

Palermo, 22-26 settembre 2025



Università degli Studi di Palermo

INTERNATIONAL YEAR OF Quantum Science and Technology

Polo Didattico del Campus dell'Università di Palermo

A cura di Barbara Alzani, Marco Bellacosa e Giovanna Bianchi Bazzi
Redazione dei testi a cura di Barbara Ancarani e Marco Bellacosa
Progetto grafico a cura di Simona Oleandri

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ISBN: 978-88-7438-144-9

Ultra-short-term analysis of cardiovascular interactions at rest and during stress using stochastic interaction.

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Recently, a growing interest has been paid to the study of the complex regulatory mechanisms of the human organism, such as cardiovascular coupling usually assessed through bivariate analysis of the interactions between beat-to-beat variability of heart period and systolic arterial pressure (SAP). The increasing use of low-cost wearable devices has also showed the need for evaluating the reliability of Ultra-Short-Term (UST) variability analysis, with reduced storage requirements compared to traditional 300-beat-long short-term (ST) recordings. This study investigates the reliability of stochastic interaction of cardiovascular dynamics computed from UST time series if compared to ST recordings. The analyses have been carried out on electrocardiographic R-R intervals and SAP time series acquired on 127 healthy young volunteers (75 females; age: 18.6 ± 3.3 years), all normotensive and with normal body mass index, at rest and during postural and mental stress. Results evidence that although shortening the time series reduces the correlation with ST data, the stochastic interaction computed from UST series of down to 180 samples can still reliably discriminate rest from stress condition.

Development of an explainable AI model for early classification of MCI and Alzheimer's disease using T1 MRI scans.

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This research project focuses on the development of an explainable artificial intelligence (XAI) model for the classification of patients with Mild Cognitive Impairment (MCI) and Alzheimer's Disease (AD). The goal is to combine the accuracy of convolutional neural networks (CNN) with the transparency and interpretability that are crucial in clinical settings. The data used come from the ADNI (Alzheimer Disease Neuroimaging Initiative) database, with a particular focus on T1 MRI MPRAGE scans, extracted using the FastSurfer tool. A CNN was trained on these images for disease classification, while an explainability technique based on Grad-CAM was integrated to highlight the brain areas relevant to classification, enhancing model interpretability. The project is funded by the AD-RICAMI program, Spoke 2, PNRR, within the RAISE program, aiming to provide a diagnostic tool that is not only accurate but also understandable and usable by healthcare professionals. Initial results show promising clinical applications for the early diagnosis of neurodegenerative diseases.

Implementation of an AI-based motion correction pipeline in brain MR spectroscopy.

Rossi C. [1][2], Lonardo A. [1], Ciardiello A. [3], Giagu S. [1][2], Maiuro A. [2][4], Capuani S. [3], Giove F. [4], Argiento B. [1], Rossi E. [1]