DIPARTIMENTO DI SCIENZE MATEMATICHE E INFORMATICHE, SCIENZE FISICHE E SCIENZE DELLA TERRA
Dottorato di Ricerca in Fisica

Appunti di Fisica '24

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Sala Seminari, CNR-IPCF

Nanoplastic detection in environmental media: a transdisciplinary challenge to understand nanoplastic occurrence and fate in the environment

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Plastic production has been exponentially increasing since 1950 and so has plastic waste mismanagement. While we have more and more information regarding the occurrence of microplastics (MP) in the environment, data on nanoplastics (NP) are scarce. NP are potentially present in all ecosystems, representing a threat for the living organisms. Due to their size and surface/volume ratio, they are likely to penetrate membranes while carrying pollutant on their surface. It is thus important to assess NP occurrence and fate in the environment.

In this aim, we tested a novel NP extraction method and scanning transmission X-ray spectro-microscopy (STXM) in combination with near-edge X-ray absorption fine structure spectroscopy (NEXAFS) to image and identify individual NP in environmental and food matrices. Additionally, we used STXM-NEXAFS to characterize depth profiles of the surface alteration of weathered MP and better understand NP formation and release in the environment.

Finally, to allow a higher sample throughput, we are currently testing NP characterisation in a wide range of media (air, water, soil) using an innovative combination and alignment of μ Raman spectroscopy (RS), scanning electron microscopy coupled with energy dispersive x-ray spectroscopy (SEM/EDX), pyrolysis gas chromatography mass spectrometry (Py-GC/MS) and artificial intelligence (AI). The aim is to use the RS and Py-GC-MS data to train a machine learning model to be able to automatically characterise NP in environmental samples using SEM/EDX data. In case of success, this model would provide for the first time a full characterization of environmental NP with a high sample throughput. This methods combination could then give a more accurate assessment of the NP pollution in the environment.