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

Appunti di Fisica '22

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Artificial Neural Network-Laser-Induced Breakdown Spectroscopy Analysis of Plasmas

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We developed an artificial neural network method for characterising crucial physical plasma parameters (i.e. temperature, electron density, and abundance ratios of ionisation states) in a fast and precise manner that mitigates common issues arising in evaluation of laser-induced breakdown spectra. The neural network was trained on a set of laser-induced breakdown spectra of xenon, a particularly physically and geochemically intriguing noble gas. The artificial neural network results were subsequently compared to standard local thermodynamic equilibrium model. Speciation analysis of Xe was performed in a model atmosphere, mimicking gaseous systems relevant for tracing noble gases in geochemistry. The results demonstrate a comprehensive method for geochemical analyses, particularly a new concept of Xe detection in geochemical systems with an order-of-magnitude speed enhancement and requiring minimal input information. The method can be used for determination of Xe plasma physical parameters in industrial as well as scientific applications.