

# OATo/UniGe Synergy - Integrating Observations and AI: Transformative Approaches for Unraveling Solar Activity

*Wednesday 21 May 2025 11:15 (20 minutes)*

The Solar Physics group at the Astrophysical Observatory of Torino (OATo), part of the National Institute for Astrophysics (INAF), stands at the forefront of solar physics research. It specializes in investigating the solar wind and eruptive events - from the dynamic layers of the solar atmosphere to the complexities of the inner heliosphere - through a multi-instrument, multi-spacecraft approach. By combining remote-sensing observations with in-situ measurements, it is possible to obtain a comprehensive picture of the physical processes driving Space Weather. In collaboration with the University of Genova (UniGe), which brings extensive expertise in applying Artificial Intelligence (AI) to solar physics and Space Weather forecasting, the OATo Solar Physics research integrates advanced AI methodologies with robust, physics-based models. This synergy ensures that AI-driven predictions are firmly rooted in the fundamental mechanisms governing solar activity. Such a reverse-engineering approach has allowed OATo and UniGe to gain fresh insights into the initiation of solar events, particularly flares and Coronal Mass Ejections (CMEs), areas where many questions still remain unanswered. During this talk, examples of how these integrative strategies - melding state-of-the-art remote-sensing observations with in-situ measurements and incorporating AI-driven approaches - have advanced the understanding of key solar phenomena will be presented. This presentation will showcase how AI has not only improved the interpretation of observational data but has also opened new avenues for exploring largely uncharted aspects of solar activity. The objective is to illustrate the transformative potential of integrating observational expertise with data-driven AI techniques to enhance Space Weather forecasting and to stimulate further exploration in this promising field.

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**Session Classification:** Team Activity Reports