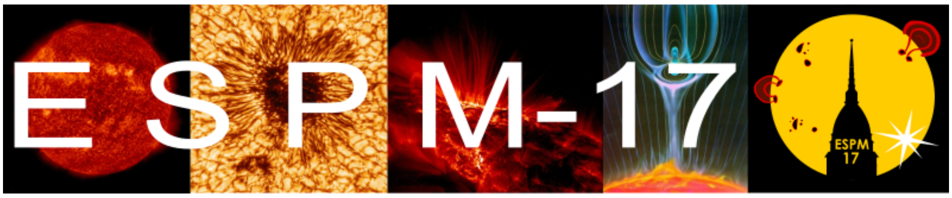

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Chromospheric Magnetic Field Reconstruction through Neural Field Assisted Spectropolarimetric Inversions

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Spectropolarimetric observations provide valuable information about the physical conditions in the solar atmosphere, particularly the magnetic field. However, traditional pixel-by-pixel inversion techniques fail to capture the inherent spatial and temporal coherence of the solar atmosphere. To address this limitation, we propose a novel approach that utilizes neural fields (NFs) to perform spectropolarimetric inversions. NFs leverage compact neural network parameterization to represent continuous physical quantities. This allows us to impose spatio-temporal constraints on the inferred magnetic field, improving the fidelity of the reconstruction compared to the standard pixel-wise approach, especially in noisy scenarios.

We demonstrate the superior performance of NFs in performing chromospheric inversions under the weak-field approximation (WFA) in different spectropolarimetric observations from the Swedish 1-m Solar Telescope (SST). Moreover, the NF framework seamlessly integrates external constraints, such as alignment with the orientation of the chromospheric fibrils or similarity to pre-computed magnetic field extrapolations, further improving the fidelity of the inferred magnetic field. This work showcases the potential of NFs for future instruments with large fields of view, thanks to their compact representation and the ability to impose spatio-temporal constraints to improve the magnetic field reconstruction in the solar atmosphere.

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