

INVESTIGATING STELLAR MAGNETISM (IN EVOLVED STARS) IN MEXICO



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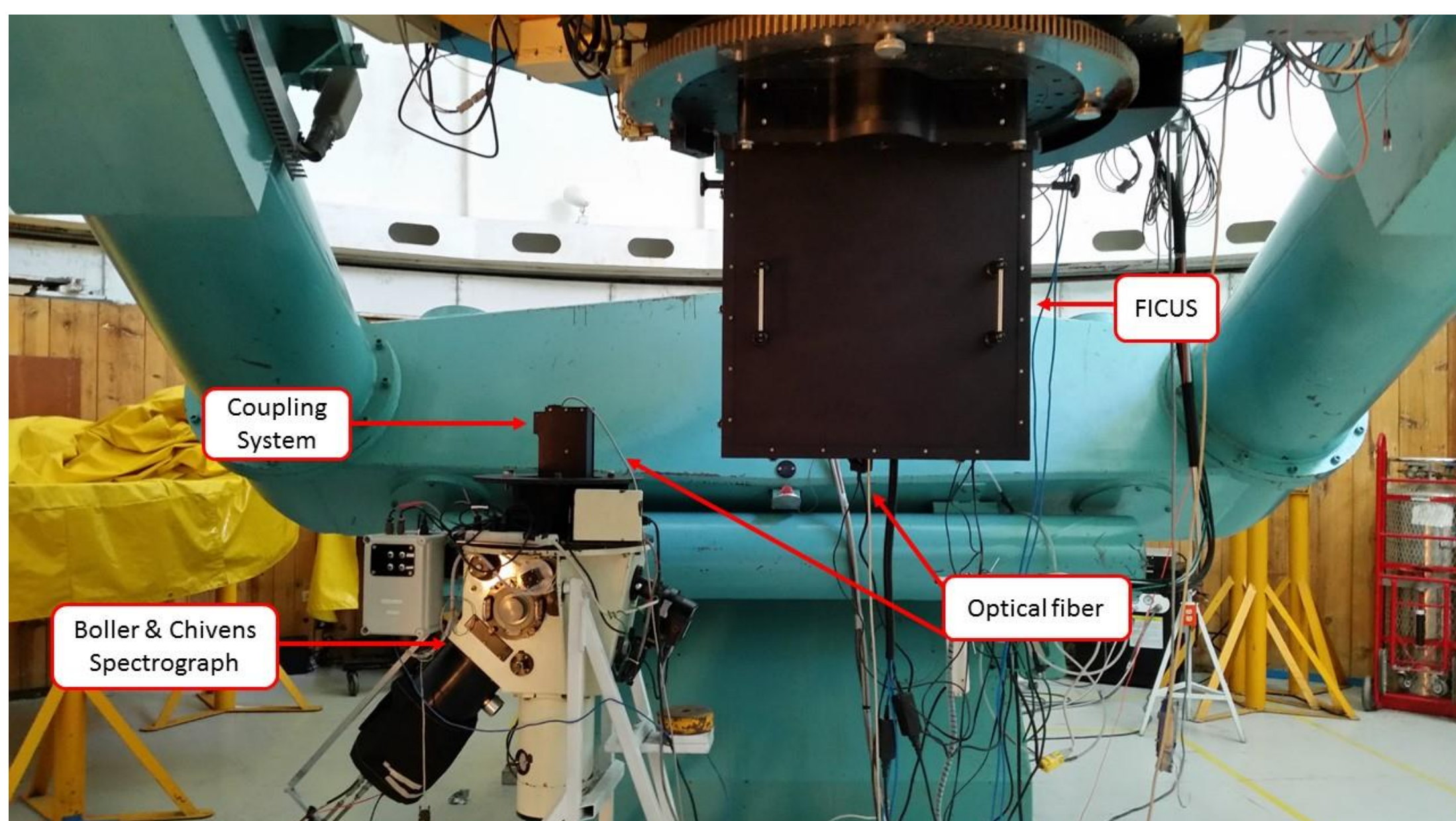


Introduction

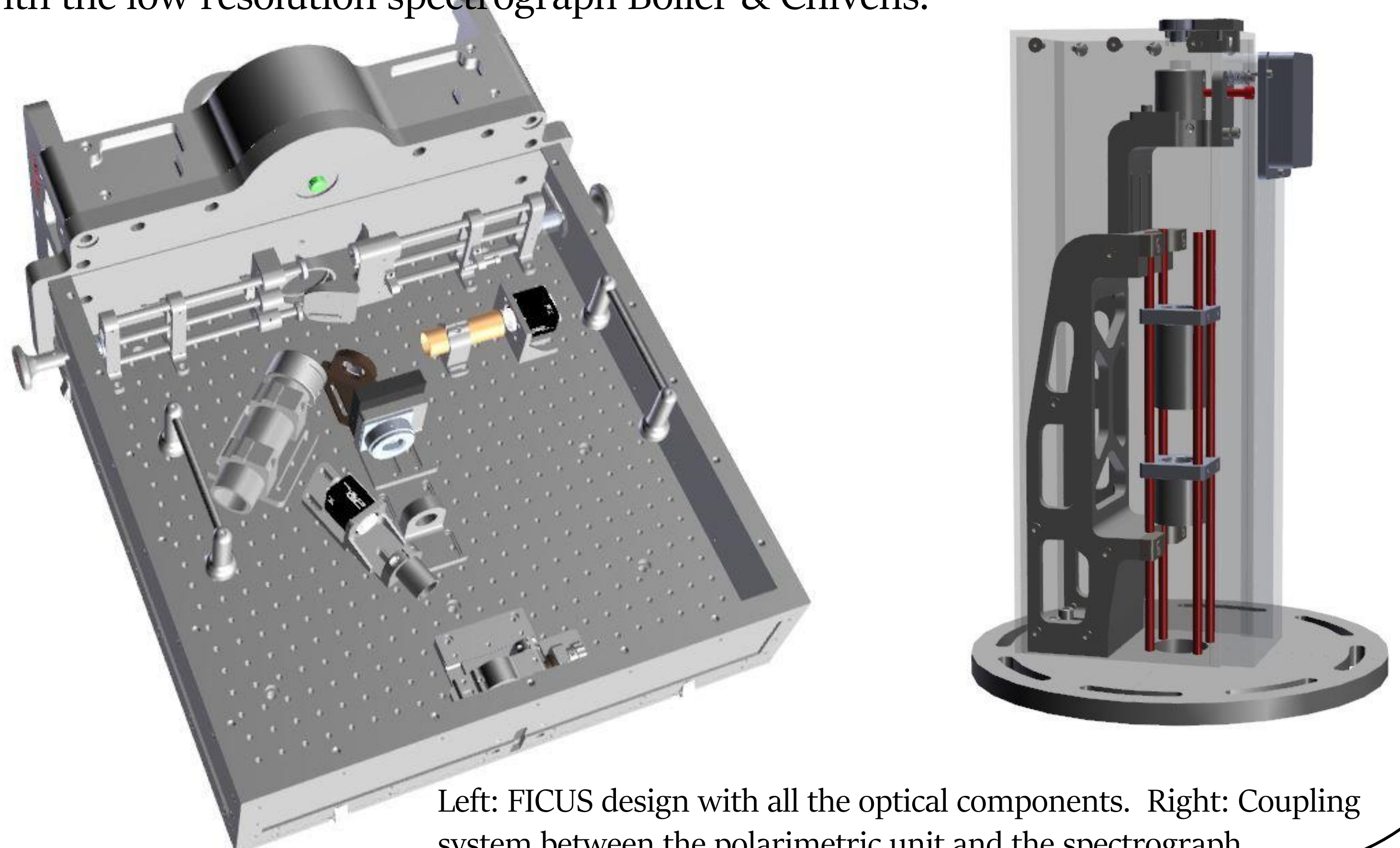
Polarimetric data have been used to determine the geometry and intensity of magnetic fields of astronomical objects along the HR diagram. However, in the case of intermediate evolved stars (e.g. Post-AGB, PNe), few observational data (compared to the total number of the different populations) have been so far obtained. This scarcity exists whether it is about mapping magnetic fields geometry using sub-mm/radio polarimetry (Sabin et al, 2014) or measuring the magnetic fields intensity using optical spectropolarimetry (Sabin et al. 2015). The main goal is to understand the role of magnetism in these generally asymmetric objects. We therefore present the latest instrumental and theoretical developments performed at UNAM regarding the detection and analysis of magnetic fields in various stars and particularly the evolved ones.

FICUS: The Fiber Coupled Unit System

The 2.1m telescope at the San Pedro Mártir Observatory in Mexico (OAN) is now equipped with a polarimetric unit designed and built at the Institute of Astronomy of UNAM in Ensenada (Mexico). **FICUS**, the Fiber Coupled Unit System, is a polarization module that can be connected to the spectrographs of the OAN via a set of optical fibers. This system would thus provide good quality polarimetric data. Only the polarimetric module is attached to the telescope, and since the spectrograph is detached, more stability is obtained for the spectropolarimetric data. Finally, as its name suggests FICUS can be coupled to any spectrograph located at the OAN, implying that either low, medium or high resolution are achievable. FICUS is now in its ultimate commissioning phase with the low resolution spectrograph Boller & Chivens.



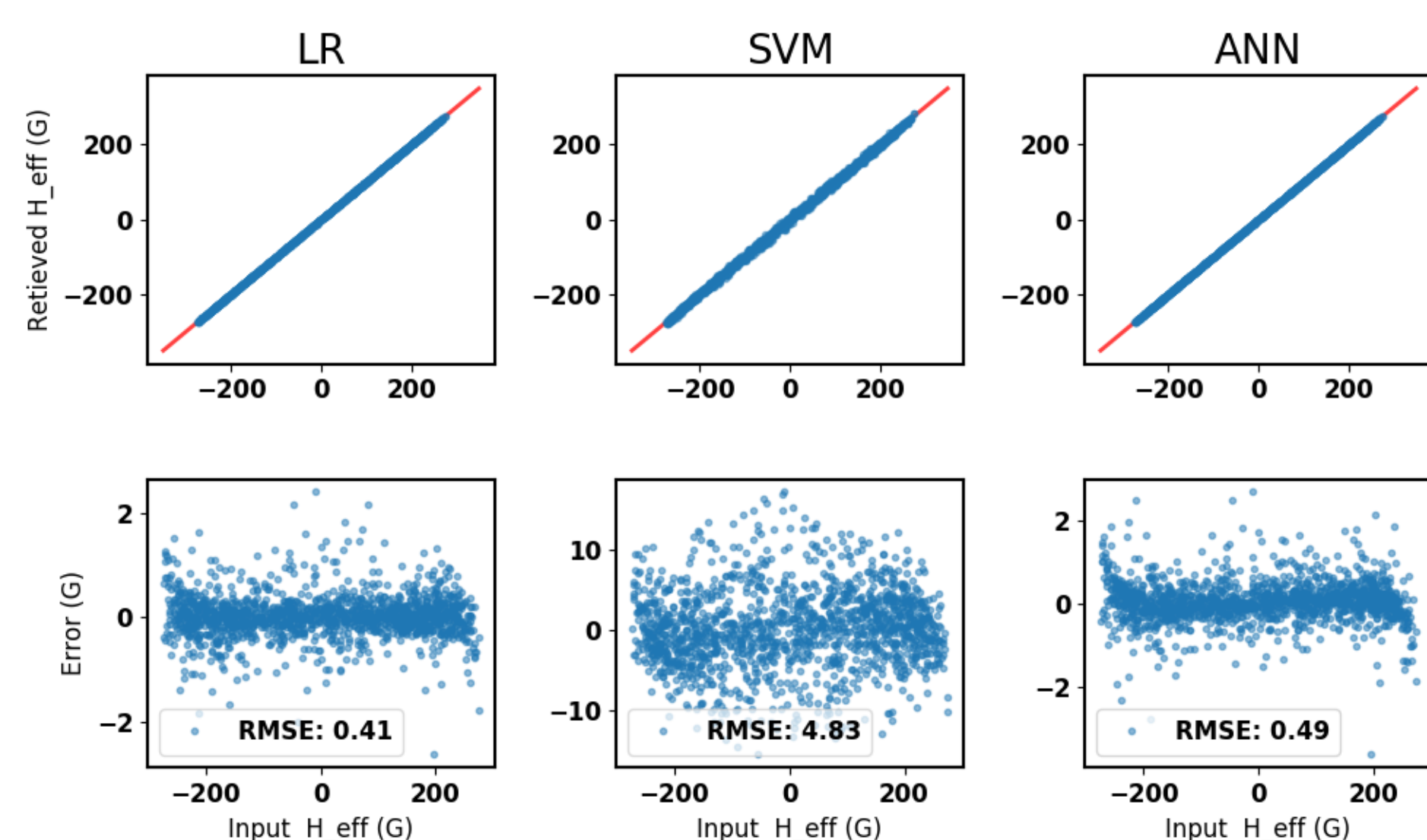
Full polarimetric system mounted on the 2.1m with the Boller & Chivens spectrograph



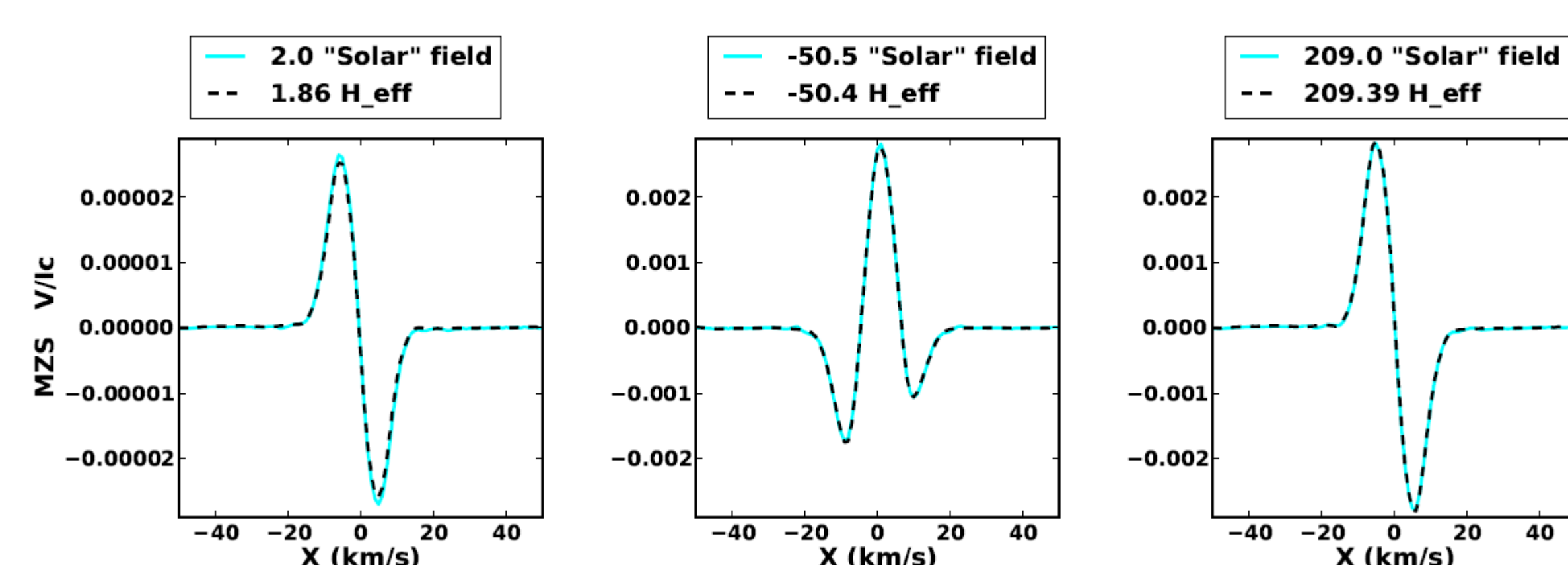
Left: FICUS design with all the optical components. Right: Coupling system between the polarimetric unit and the spectrograph.

Spectropolarimetric data analysis with the PCA/ZDI method

In order to analyze the data obtained with FICUS (or any other spectropolarimeter) and study the magnetic fields a new data inversion code has been developed at IA-UNAM. The latter is based on the technique of Principal Components Analysis associated to theoretical radiative transfer models (PCA/ZDI). It will therefore be possible to have a robust estimation of the intensity.



Accuracy of the inversions of a sample of 1,500 MZS, using 3 different algorithms, all based in a machine learning approach. (Ramírez Vélez et al., in prep).



We present 3 fitted MZS profiles (similar to LSD profiles) using a full radiative approach (Ramírez Vélez et al., 2016).

Conclusion

The detection, measurement and analysis of stellar magnetic fields will now be possible at the OAN-MEXICO as we can count on the appropriate instrumentation and supporting data analysis tool. Those first steps are a prelude to more R&D in the future.