COST Action MP1104
Short Term Scientific Mission

ORIGIN AND EVOLUTION OF STELLAR MAGNETIC FIELDS

Beneficiary: Stefano Bagnulo, Armagh Observatory, United Kingdom
Host: Martin J. Stift, Institut fuer Astronomie, Universitaet Wien, Austria
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SCIENTIFIC REPORT

Our long-term project is to set constraints to the theories that explain the origin and evolution of stellar magnetic fields. To achieve this result, we firstly need to critically address the problem of detection and modelling of magnetic fields. This first phase is due to conclude in approximately 12 to 18 month time. Next, using an existing database of spectro-polarimetric observations complemented by new observations, we will apply a new Zeeman Doppler Mapping code to a number of A-type stars with known age to check if and how the morphology of the magnetic field evolve during the life of the stars on the main sequence. We will finally investigate the magnetic field of both massive stars and late M dwarf stars, to search for similarities with the morphologies of the magnetic fields of A-type stars. To achieve this goal, we are developing a new software for Zeeman Doppler Mapping based on the radiative code COSSAM written by Prof. Martin Stift (e.g, Stift et al. 2012, MNRAS, 419, 2912).

COST action MP1104 funded a two-week visit in December 2012 of Stefano Bagnulo to the Institute of Astronomy of the Vienna University, to meet with Martin Stift. In the course of this Short Term Scientific Mission we have been dealing with the issue of how to model stellar magnetic fields. More specifically:

1) We have been discussing and (so far successfully) experimenting with two different inversion algorithms, to assess how we can retrieve the magnetic morphology more efficiently starting from a set of observed Stokes profiles.
2) We have been discussing how to parametrise the magnetic field, and how best to graphically visualize it.
3) We have examined the role of systematic instrument effects, such as, e.g., cross-talk from circular to linear polarization.
4) Finally, we have achieved a substantial improvement in the efficiency of the spectral synthesis in non-magnetic atmospheres.

During the first week, PhD student Alex J. Martin, funded by the Armagh Observatory and by an UK STFC grant, joined Stefano Bagnulo and Martin Stift, and worked mainly on the implementation of the inversion algorithms and (later) on the visualization of the magnetic field.

In the next few months we will continue to work on tasks 1) and 2), and will start systematic numerical experiments aimed at assessing the reliability of the solutions provided by inversion algorithms. We foresee a visit of Prof. Stift to the Armagh Observatory in 2013.