Part 1 - General Information

Project Title: Observations and theoretical modelling of the wing polarization in strong resonance lines formed in the solar atmosphere
Keywords: Solar atmosphere, polarization, Hanle-Zeeman effect, realistic modelling, polarimetric observations
Start date: August 15, 2009
Duration: 2 months

Part 2 - Exchange Participant(s) Details

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Part 3 - Scientific & Technical Information

3.1 Purpose of visit

The purpose of this visit was to continue our ongoing collaboration, started in 2004. Specifically we planned to develop high speed methods to model the «second solar spectrum», the linearly polarized spectrum of the Sun that is due to scattering processes. To this end a visit of Ms. L. S. Anusha and Dr. K. N. Nagendra to IRSOL, Switzerland, was organized. The goal of the visit included performing observations of intensity, and polarized spectrum of several important lines, using the advanced facilities available only at IRSOL.

3.2 Short description of work carried out during the visit

1. The code for handling multilevel coupling between atomic levels was incorporated into the project. Further this code was used to provide realistic intensity spectra, opacities, etc, which are necessary to compute the polarization of the line spectrum.
2. The polarization is computed by a perturbation method which was also well tested and adopted for our project.
3. Polarimetric observations were performed in several lines for testing the theoretical framework developed before the actual visit.

The ZIMPOL - II and III polarimeters at IRSOL are the best equipments in the world to obtain high precision polarimetric data on spectral lines. In the 2009 visit and the previous visits, we have learnt to use ZIMPOL -II. The theoretical techniques that we developed in the 2009 visit can be extended through applications to the observations of the three new lines done at the same visit. The ZIMPOL polarimeters allow optimal solutions for the following reasons:

1. The telescope field of view corresponds to the 1% of the whole solar disk; most of the energy is removed at the primary focus that drastically reduces undesired instrumental scattering effects.
2. The Czerny Turner spectrograph has an excellent optical quality, and introduces only small amount of scattered light.
3. To point the telescope at the desired position, both the primary image guider system, and the encoder positioning of the telescope system are used.
4. The images taken using the slit jaw CCD camera, can be used to determine the spatial information on the disk with high precision.
5. The scattering linear polarization (second solar spectrum) measurements are performed in order to compare it with the model profiles. These measurements are performed with ZIMPOL using PiezoElastic Modulator (PEM).
6. The data reduction is performed using the well tested and proven IDL data reduction codes.

3.3 Outcomes

The outcomes of the visit are:

1. Perfecting the existing codes for modelling the second solar spectrum. These codes were used to publish few papers. (Sampoorna et al. 2009a; Sampoorna 2009b; Nagendra et al. 2009)
2. Data reduction and analysis methods were learnt
3. The generalization of the so called last scattering approximation (LSA) codes were taken up.
4. A publication would be issued in the coming months on the work done during the 2009 visit.
References

1. K. N. Nagendra, L. S. Anusha, & M. Sampoorna 2009, in Mem. S. A. It., 80, 675
3. Sampoorna, M. 2009b, in Mem. S. A. It., 80, 693

3.4 Future collaboration with host institution

The ongoing major project is not yet completed. It needs few visits to IRSOL, Switzerland, and the follow-up calculations to be performed at Bangalore.

3.5 Various comments

ISJRP is well organized. All worked well.

3.6 Projected publications/articles resulting or to result from the exchange

A major publication will be issued during December 2009.