

Results of the May 2015 Meeting of the ISSI Team on "Improving the Analysis of Solar and Stellar Observations"

Websites

- [OFFICIAL ISSI Team website](#)
- [ISSI Team working website at CfA](#)

Team's Stated Goal

"During the past several decades the amount of high quality solar and stellar data has exploded. These data, however, must be interpreted in the context of complex atomic processes to derive insights into the underlying physics. It is unclear how robust our inferences can be once the uncertainties in the atomic data and instrument calibration are properly accounted for. The goal of this team is to develop and apply the robust statistical techniques needed to fully understand the limits of our ability to interpret remote sensing observations."

Broadly speaking, this project entails a chain of specialists in astrophysical atomic data, statistics, and astrophysical data analysis working together to understand and carefully propagate uncertainties in the atomic physics up to the analysis of spectral observations.

Strategy to Achieve Goal

A two-stage stepped strategy for the project was identified at this ISSI meeting:

- A. Determine densities from observations using density-sensitive line-ratio analysis.**
- B. Determine emission measures and temperatures from observations using differential emission measure (DEM) analysis.**

The first objective represents a better understood analysis technique, with clearer and less complex challenges to address.

The second objective represents a more difficult but desirable analysis to achieve.

The Team believes that the first objective (density-sensitive line-ratios) can be reached in less than a year, leading to one or more publications, as well as to a poster presentation at the Hinode-9 Science conference in September 2015. The second objective (DEMs) was identified at this ISSI meeting, and some of the challenges discussed, but a detailed plan of attack is pending the experience with the first objective.

ACTION ITEMS

(Team members named below.)

Atomic physics:

- (HW, GDZ): Select Fe XIII emission lines of interest between 196 and 202 Å.
- (HW): Compute library of atomic data for Fe XIII and O VI using *uniform* uncertainties for atomic models.
- (RS, GDZ): Prepare *non-uniform* uncertainties for atomic models. Compute library of atomic data.

Statistics:

- (VK, HW): Perform PCA on density ratio curves.
- (DVD+): Full inference of densities on real and MHD data. Joint analysis for two line-ratio sets of curves. Start with curves from *uniform* uncertainty on line-ratio curves, then proceed when GDZ provides *non-uniform* uncertainty versions for atomic data and instrument uncertainties.
- (DVD+): Start thinking about how to build a modular DEM analysis. First just simplest available errors. Add in CSDs and other complications later.

Data / Models / Instruments:

- (HW, VK): Collect line intensities for Fe XIII (EIS) and O VI (Chandra) in both observed counts and absolute units.
- (HW): Compute intensities for Fe XIII and O VI from MHD simulation.
- (HW, GDZ): Provide instrument uncertainties for density problem.
- (MW, HW, FA): Provide calibration curves for EIS, MAGIX, LEMUR so we have a consistent list of lines for DEM analysis.

DEMs:

- (CG): Redo analysis to see how far to turn down the uncertainties in order to be able to solve the DEM problem.
- (MW, NS): Study how to represent "multiplicity problem" of DEMs with errors.
- (MW, NS): Study how to represent DEM uncertainties.

Infrastructure:

- (HW): Create and support GitHub repository for initial data products.
- (VK): Maintain websites.
- (MW, HW): Organize Hinode-9 poster in Sept 2015.
- (HW): Make arrangements for next meeting and coordinate group.

Team Members

HW:	Harry Warren	(NRL; PI)
CG:	Chloe Guennou	(Columbia)
DS:	David Stenning	(UCI)
DVD:	David van Dyk	(Imperial)
FR:	Fabio Reale	(Palermo)
FA:	Frederic Auchere	(Inst. Astr. Spatiale)
GDZ:	Giulio del Zanna	(Cambridge)
IA:	Inigo Arregui	(Inst. Astr. de Canarias)
JC:	Jessi Cisweski	(CMU)
MW:	Mark Weber	(SAO)
NS:	Nathan Stein	(UPenn)
RS:	Randall Smith	(SAO)
VD:	Veronique Delouille	(Royal Obs. Belgium)
VK:	Vinay Kashyap	(SAO)

Future Meetings

Next Meeting:

- There was a preference for having one of the travel days on Sat or Sun, to minimize the number of work days impacted.
- Discussion on whether to plan 3 vs 4 days for next mtg.
- Seems like 2016 March 21--23 was our final answer.

Final Meeting:

- ISSI indicated that all meetings should be completed by the end of 2016.
- Nov, Dec de-preferred for holiday season.
- Sounds like 2016 Oct or early Nov would be best.