

Summary of WG5 Activities during ISEEST 2017



Spiros Patsourakos, University of Ioannina, Greece

Overarching Goals of WG5

Observe (infer) the magnetic field of CMEs in the corona and in the inner heliosphere and understand the related physics

Predict CME magnetic field at 1 AU

Combination of observations, modeling and theory

Spiros Patsourakos

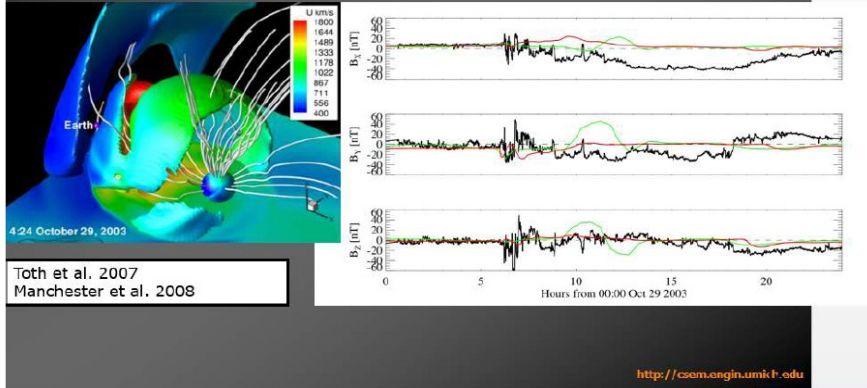
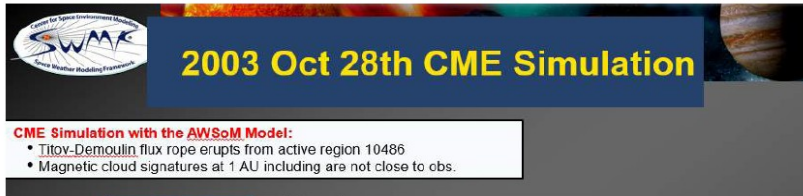
Report of various methods of CME magnetic field inference

H-CME method: coronal CME magnetic field from magnetograms
WL images & Hm conservation in flux-rope CMEs

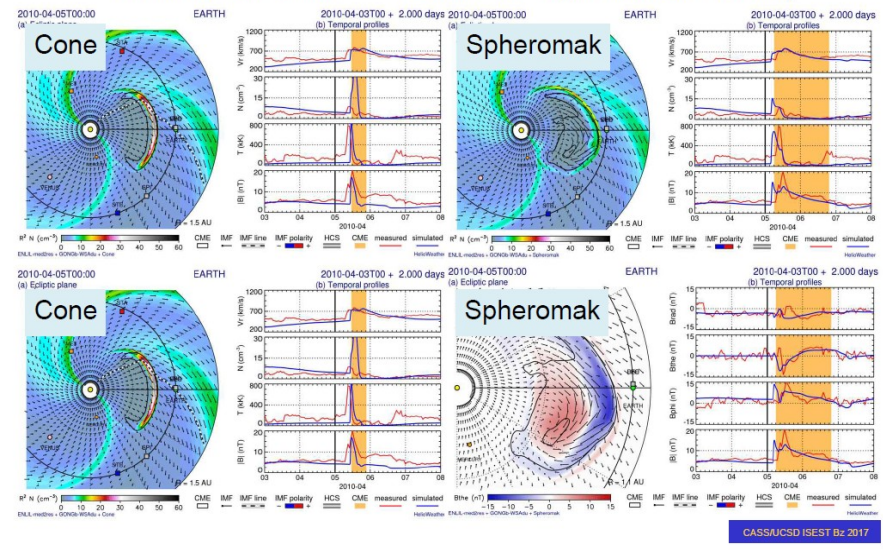
All methods have pros+cons

Bernie Jackson(theme-setting) I

Fm Ward (Chip) Manchester **CMEs**



Fm Dusan Odstrcil **CMEs**
2010-04-03 CME — “Cone” vs “Spheromak” density



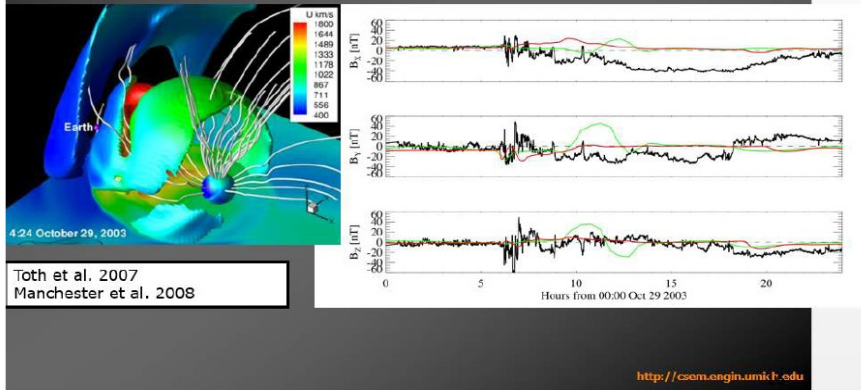
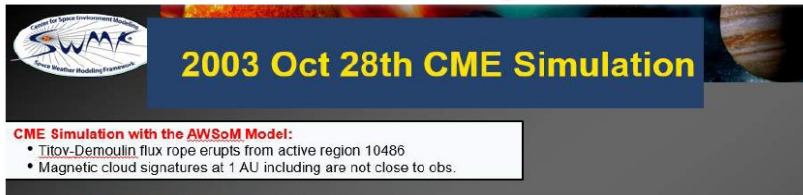
Review of recent advances in measurements of B_z in background solar wind and CMEs

MHD models

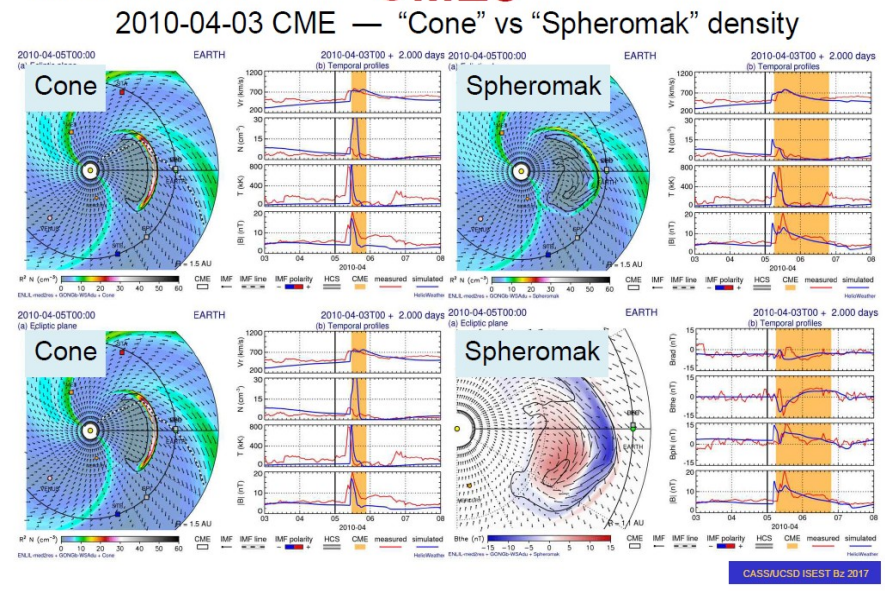
“end-to-end”: corona—>IP--> 1 AU & beyond
Heliospheric: 0.1 AU ---> 1 AU & beyond

Bernie Jackson(theme-setting) I

Fm Ward (Chip) Manchester **CMEs**



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Review of recent advances in measurements of B_z in background solar wind and CMEs

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Bernie Jackson II

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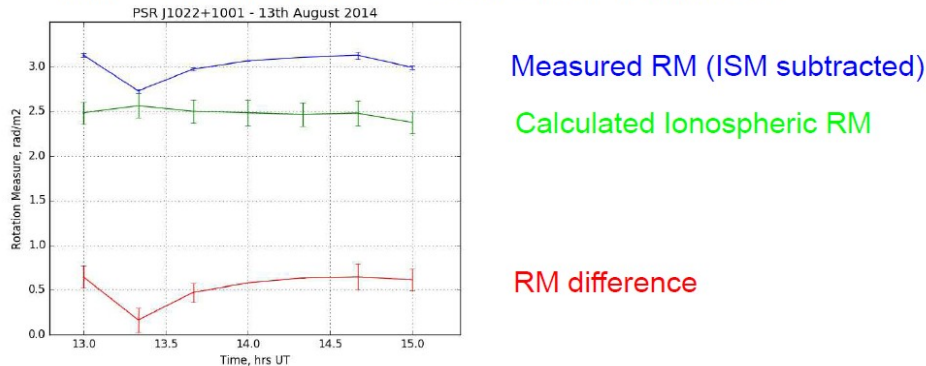
Fm Mario Bisi

Heliospheric FR Observations (3)

Time	Observed RM	Ion RM	Total RM
13:00	3.12722 ± 0.02	2.48140 ± 0.12264	0.64582 ± 0.12426
13:20	2.72809 ± 0.02	2.56207 ± 0.13366	0.16602 ± 0.13515
13:40	2.97102 ± 0.02	2.49809 ± 0.12492	0.47293 ± 0.10598
14:00	$3.06306 \pm \text{---}$	2.48251 ± 0.14120	$0.58055 \pm \text{---}$
14:20	$3.10321 \pm \text{---}$	2.46633 ± 0.12987	$0.63688 \pm \text{---}$
14:40	3.12737 ± 0.04	2.47916 ± 0.13886	0.64821 ± 0.14451
15:00	2.99077 ± 0.02	2.37482 ± 0.11960	0.61595 ± 0.12126

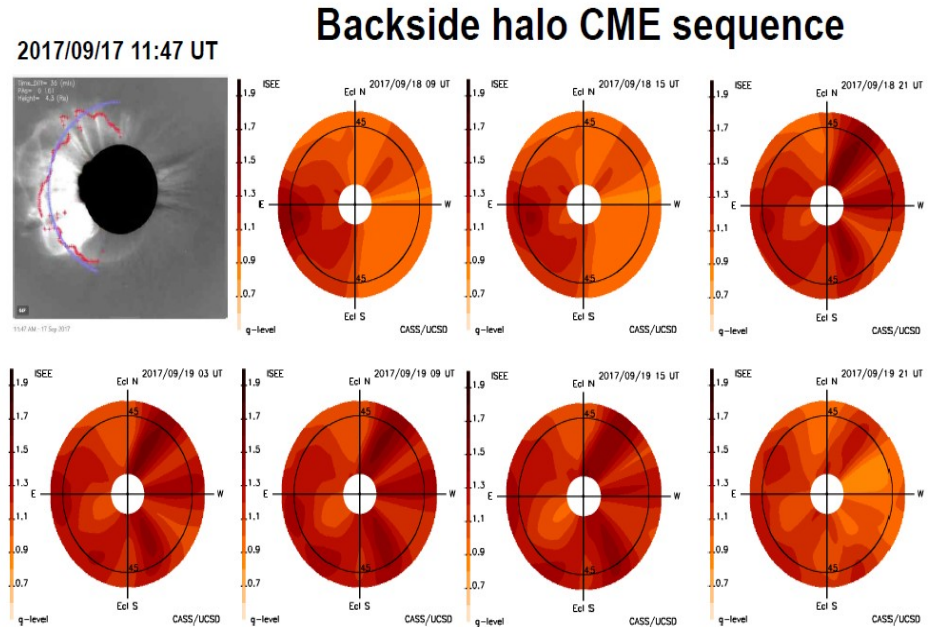
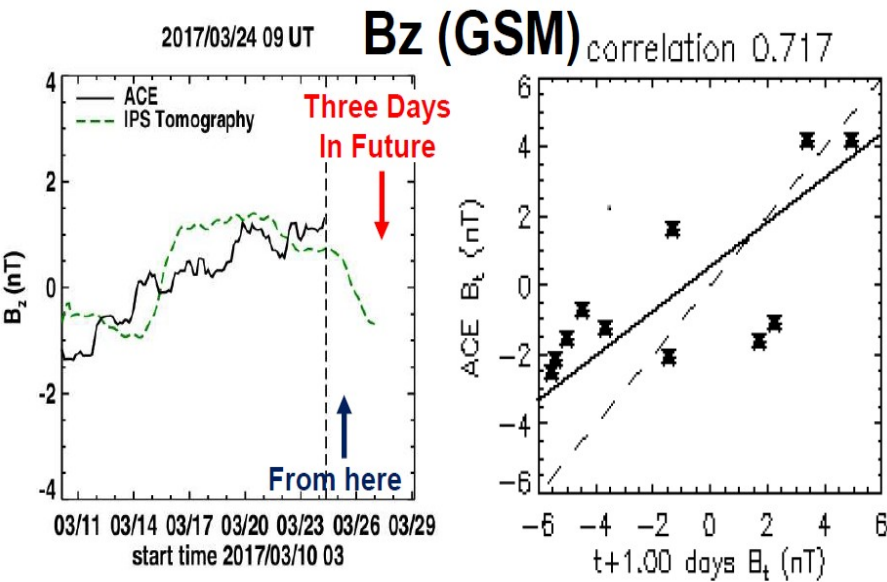
Fm Richard Fallows **Heliospheric Remote Sensing**

RM Calculations – Current Estimates



Encouraging results on possible Faraday Rotation rotation
IP detection in CMEs by LOFAR

Bernie Jackson III

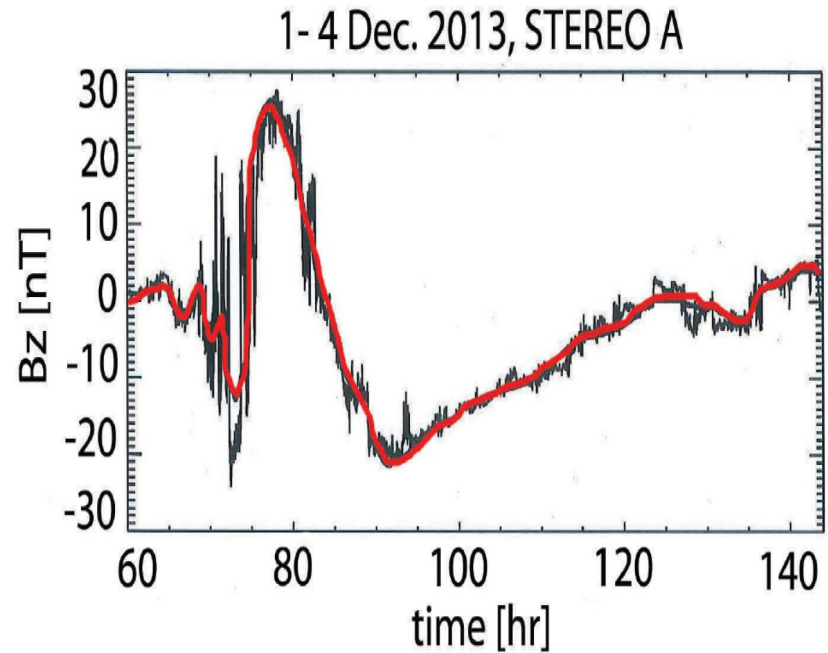
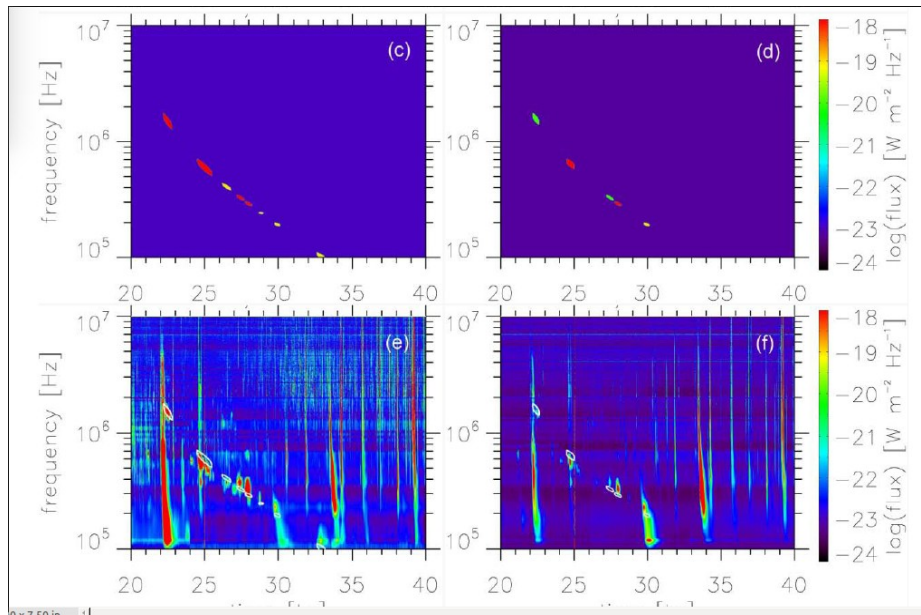


UCSD predictions based on IPS tomography & CSSS model --> good correlation between predicted B_z and in-situ observations for 1d resolution

IPS tomography captures CMEs

Encouraging results on Faraday Rotation in CMEs by LOFAR&MWA

Iver Cairns

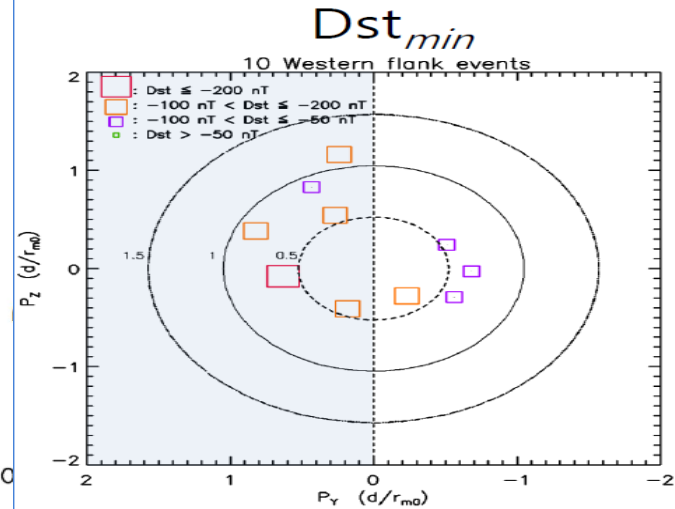
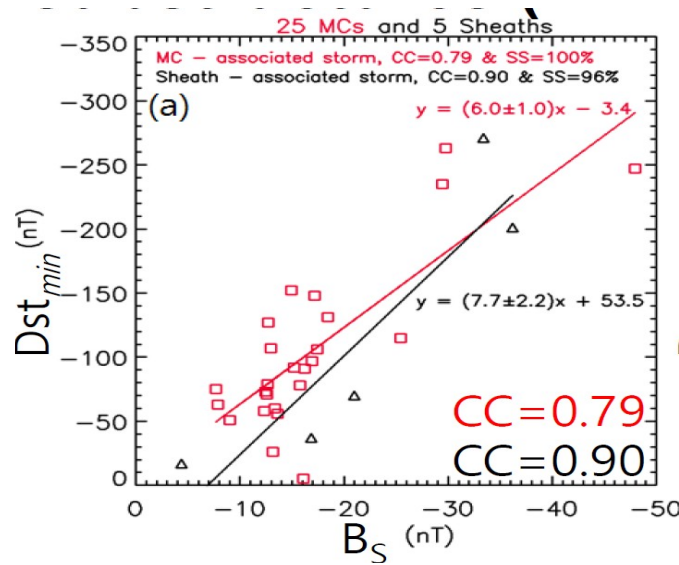
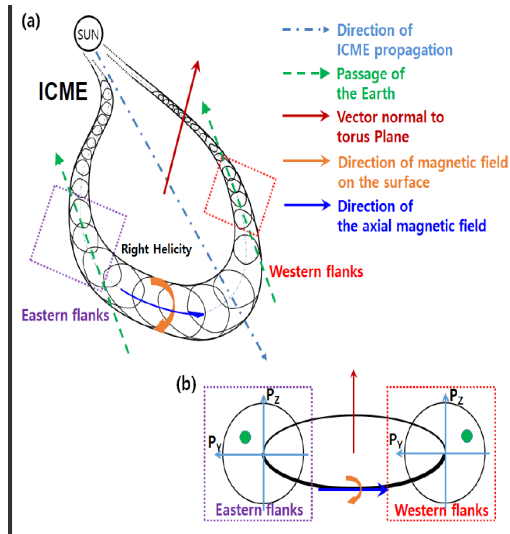


MHD model of the 29 Nov 2013 CME with the BATS-R-US code; CME properties constrained by STEREO observations

Couple MHD with analytic kinetic theory of type II's

Synthetic II, WL images and B_z at 1 AU in agreement with the observations

Jae-Ok Lee

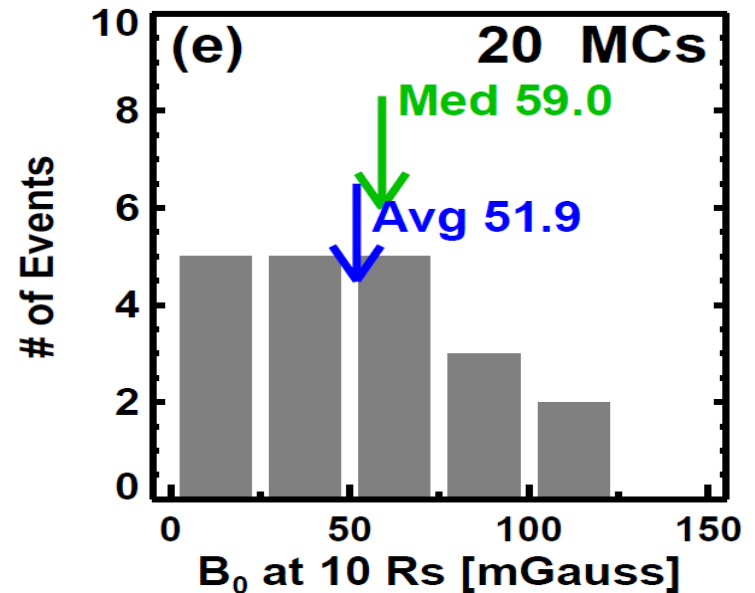
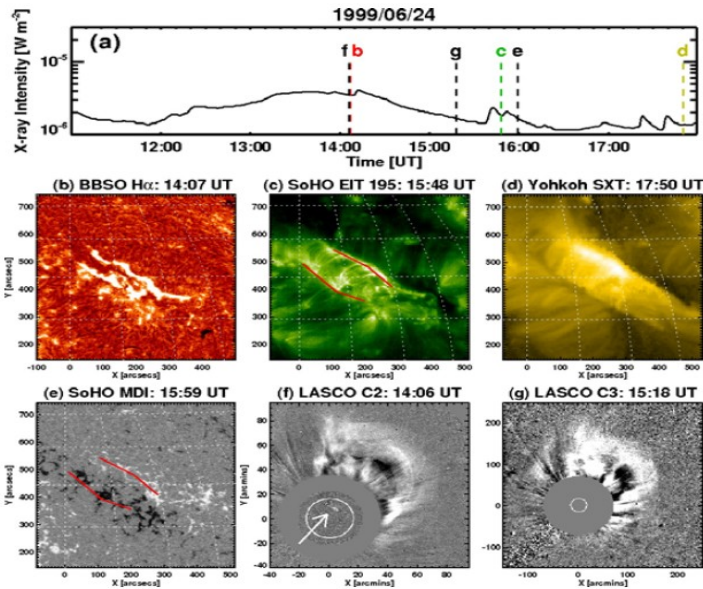


Fit a toroidal MC model to 59 ICMEs

Stronger correlation between solar wind params and Dst for sheaths than for Mcs

Geomagnetic storms occur for specific impact geometries

Nat Gopalswamy

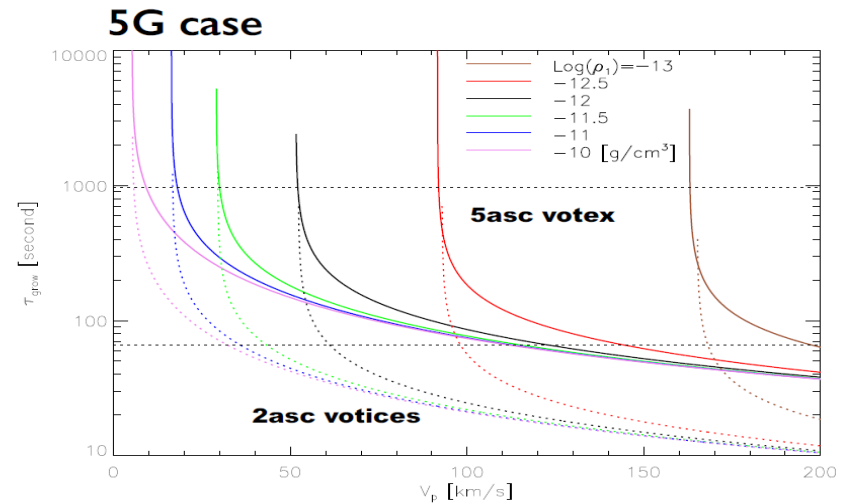
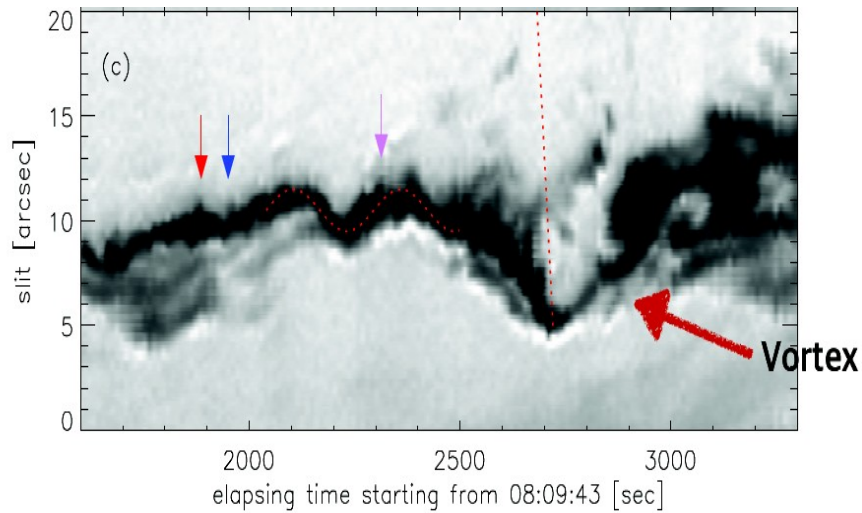


New method (FRED) of inference of CME magnetic field in the corona based on observations of the reconnected flux in post-eruption arcades and coronagraphic imaging applied to LFF flux ropes

Applied to 54 CMEs observed by LASCO ---> correlation between coronal and MC magnetic field

Applied to campaign event of 12 July 2012 with consistent results in the corona and at 1 AU

Heesu Yang



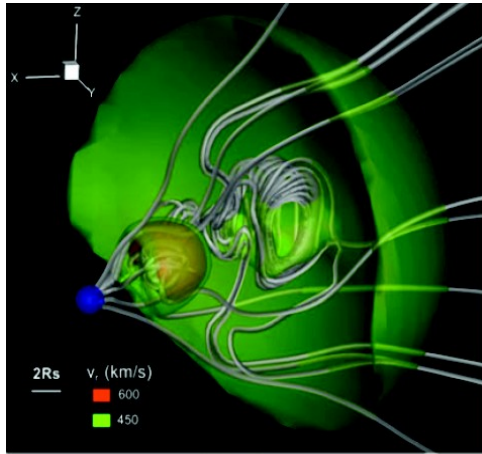
NVST observations of a prominence

Oscillations ---> vortex formation:
streaming kink instability

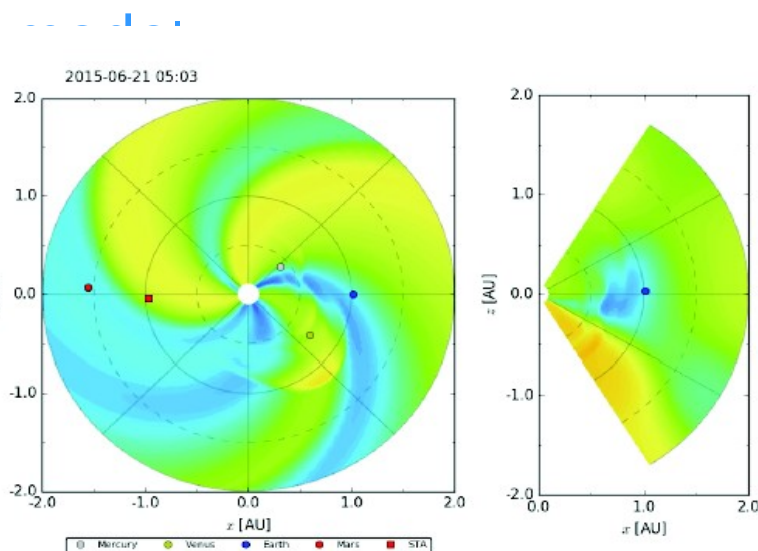
Linearized theory --> density $> 10^{-11}$ - 10^{-12} g/cm³

Some Pertinent Inputs from other Groups

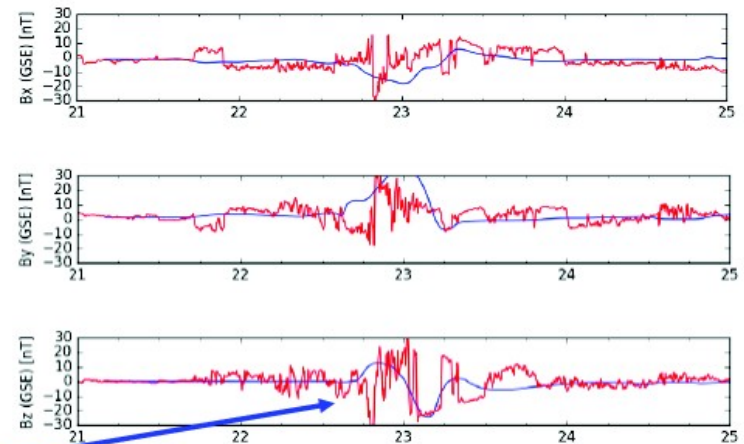
Fang Shen: COIN-TVD blob heliospheric CME model



Christine Verbeke: EUHFORIA flux rope heliospheric CME

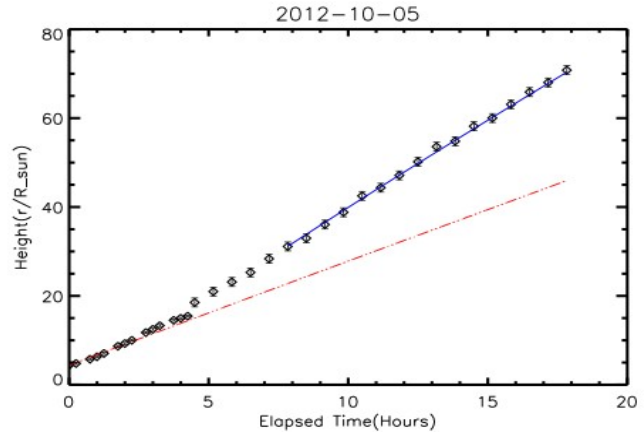


B-comp. fit with GL CME

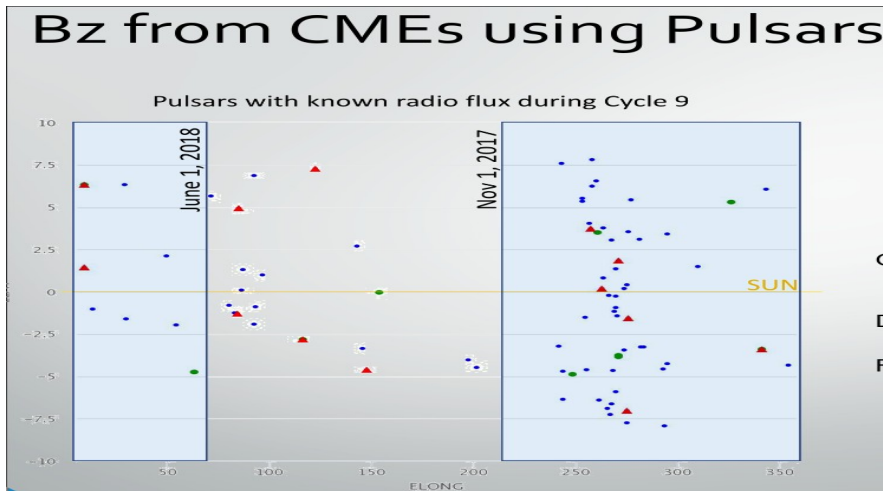


Some Pertinent Inputs from other Groups

Nishtha Sachdeva: method to infer bkg B from CME h-t



Pietro Zucca: future LOFAR observations of coronal IV's and Faraday rotation



Some Pertinent Inputs from other Groups

Yuming Wang, Chenglong Shen Fang Shen, Andrei Zhukov,
Katsuhide Marubashi :

CME rotation from Sun/Corona to 1 AU could be significant ...

The Big Picture

Growing interest and efforts in heliophysics for now and for the future

Encouraging developments from radio observations (IPS, LOFAR, MWA,...)

Advent of methods to infer the CME magnetic field in the corona

Emergence of magnetized CME heliospheric models for Space-weather predictions (EUHFORIA, COIN-TVD, ENLIL, SUNSANOO)

How about CME orientation from Sun/Corona ---> 1 AU ?

Actions I

exchange info

CME b-field observers (radio + inference): **CMEr, CMEi**

CME modelers: **CMEem**

CMEi: easy

CMEr & CMEem: difficult

When CMEem decides to model an event ---> CMEr, CMEi

When CMEr observes ---> CMEem, CMEi

Actions II

Compare Near-Sun CME |B| for different methods: FRED+H-CME.... add more methods

List of CMEs for WG5 Analysis - heliophysics - Mozilla FireFox

List of CMEs for WG5 Analysis

solar.gmu.edu/heliophysics/index.php/List_of_CMEs_for_WG5_Analysis

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List of CMEs for WG5 Analysis

List of near-Sun Observations/Determinations of CME Magnetic Fields for WG5

Date and Time	Solar Source (AR # or location)	Method of Magnetic Field Determination	Publication	Miscellaneous	Submitter contact
2011/06/07 06:47 UT	AR NOAA 11226 (CME propagating on the west limb)	The magnetic field in the corona is determined by applying the Rankine-Hugoniot equations to LASCO C2 and C3 white-light images of the CME-driven shock in order to derive a map of the shock Alfvénic Mach number	Bemporad, A. & Mancuso, S. 2010, ApJ 720, 130 (also Bemporad, A., Susino, R., & Mancuso, S. ApJ, in preparation)		R. Susino (susino@oato.inaf.it) and A. Bemporad (bemporad@oato.inaf.it)}
2012/03/07 01:14 UT	AR NOAA 11429	The coronal CME magnetic field is estimated by combination of magnetic helicity calculations of the CME source region and forward modeling of the CME along with application of the helicity conservation principle in flux-rope CMEs	Patsourakos, S., Georgoulis, M. K., Vourlidas, A. et al., 2016, ApJ, 817, 14		S. Patsourakos (spatsour@cc.uoi.gr)}

This page was last modified on 10 December 2016, at 06:10.

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Overview

Data, Campaigns, WGs

- ICME/CME Lists
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- WG1 (data)
- WG2 (theory)
- WG3 (simulation)
- WG4 (Campaign)
- WG5 (Bs)
- WG6 (SEP)
- MiniMax24
- varSITI Campaign

Workshops

- 2013 Workshop
- 2014 Workshop
- 2015 Workshop

Additional Resources

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- Useful Links
- Maintenance

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Actions III

CME rotation: theory & simulation group

Actions IV

Coronal CME B from CMEi useful for CMEr predictions of coronal Faraday rotation

Actions V-Collaboration with other teams

IMF Bz at L1 - Mozilla Firefox
IMF Bz at L1
https://ccmc.gsfc.nasa.gov/assessment/topics/helio-imf-bz.php 67% Search

COMMUNITY COORDINATED MODELING CENTER
International Forum for Space Weather Capabilities Assessment

Related Links | Frequently Asked Questions | Community Feedback | Downloads | Sitemap

About | Models at CCMC | Request A Run | View Results | Instant Run | Metrics and Validation | Education | R2O Support | Mission Support | Community Support | Tools

Forum Home | Working Teams & Topics | Overall Goals and Deliverables | Sign Up | FAQ | ICCMC-LWS Working Meeting & Presentations

IMF Bz at L1 Working Team

Leads: N. Savani, P. Riley (contact team leads/forum organizers to be added to the team)

Communications: ccmc-imf-bz@googlegroups.com (mailing list)

Participants: Eric Adamson · Nick Arge · Michael Balkhin* · Francois-Xavier Bocquet · Sean Bruinsma* · Yaireska Collado-Vega* · Pedro Corona-Romero* · Curt de Koning* · Manolis K. Georgoulis* · Edmund Henley · Bernard Jackson* · Lan Jian · Christina Kay · Noé Lugaz · Anthony Mannucci* · Periasamy K. Manoharan* · Slava Merkin* · Mariëna Mierla · Joseph Minow* · Christian Moesti · Karin Muglach* · Chigomezyo Ngwira* · Teresa Nieves · Nariaki Nitta · Dusan Odstrcil* · Mathew Owens · Spiros Patsourakos · Pete Riley · Alexis Rouillard · Neel Savani* · Camilla Scolin · Daikou Shota · Howard Singer* · Robert Steenbrughe · Manjula Temmer · Christine Verbeke* · Angelos Vouridas · Bob Weigel · Daniel Welling · Alexandra Wolf* · Yongliang Zhang · Jie Zhang · Anastasios Anastasiadis · Steven Brown* · Craig DeForest* · David Falconer · Natalia Ganushkina* · Adam Kellerman · Burcu Kosar* · Alexander Kosovichev* · Masha Kuznetsova · Ramon Lopez · Peter MacNeice* · Daniel Matthia* · Naoto Nishizuka · PAUL O'BRIEN* · Evangelos Paouris · Athanasios Papaioannou · Steve Petrinec* · Nikolai Pogorelov* · Ian Richardson* · David Sibeck · Karlheinz Trattner* · Rodney Viereck · Brian Walsh · Churning Wang* · KiChang Yoon · Yihua Zheng*

*attending CCMC-LWS working meeting

Live workshop updates

→ **April 2017 working meeting:** [team agenda](#) | [solar/hellosphere agenda](#) | [full agenda](#)

Following on from the original draft document that went out to the community, we will be discussing each of the 6 topics at the workshop. At the first session on Wednesday (04/05), we will be looking to find areas of agreement and complexities to resolves. We test a novel approach to the discussion by attempting **live and interactive updates of the conversation by the community**. The document is open to everyone, and contributions are solicited to the entire community. **Wednesday's** live updates can be found here:
→ <https://goo.gl/m2k6CP>

In addition to the **live updating** of the Wednesday session. The follow up session on Thursday will predominately attempt to focus on the future strategy and the pathways to impact and operations. **Thursday's** live updates can be found here:
→ <https://goo.gl/ZatBIR>

If anyone has ideas they wish to convey, please feel free to upload them here, and convey a summary via email to the team leads so that these points can be entered onto the floor of discussion:
→ <https://goo.gl/B2AGQO>

Working Team Goals

To create a community-agreed selection of events and metrics, that all current and future models should test their magnetic field forecasting capabilities.

In this topic the community will focus on forecasting the magnetic structure of interplanetary CMEs and the ambient solar wind upstream of Earth. This group intends to open communication with the community in order to agree upon a standardised process by which all current and future models can be compared under an unbiased test. Current models will provide the initial set of forecasting skills, with the longer term goal of providing a standardised test procedure which future model improvements can follow. This procedure is intended to provide concrete requirements to progress a scientific model along the Application Readiness Levels (ARLs) and into an operational setting. The conversation and scientific rationale behind all decisions will be recorded in order to facilitate future ARL procedures.

Solicitation for Community Opinions

We invite the wider community to participate and provide further insight that would benefit the final determination of evaluation criteria especially in those areas that remain outstanding. All new ideas are welcome, as well as additional suggestions on current evaluation themes.

A small team of model developers and end users (SWPC and UKMO) were selected to "seed" an initial direction for further discussion by the wider community. [Please find the our initial finding here.](#)

Current list of models incorporated in our discussion:

Data driven

1. Bz4Cast model (N. Savani)
2. Helicity-CME (H-CME) model (Patsourakos, Georgoulis)
3. A. Rouillard model

Numerical simulation

4. SUSANOO (D. Shota)
5. EUHFORIA (S. Poedts – under development)

Recommendation algos

6. [ProjectZed](#) model (P. Riley)

Working Team Deliverables

Physical Quantities and Metrics for Model Validation

Observation Data

List of Time Intervals in this Study

<< [Return to the forum homepage](#)

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What else ???