# ILWS related activities in Germany

Moscow, August 2, 2014

# Outline

- Update based on presentations of German ILWS activities in Vienna 2013 (after Prague, Bremen, Beijing)
- Recent developments and achievements
  - Sunrise 2
  - Solar Orbiter
- Ongoing and further German contributions to ILWS Missions
  - SOHO, CLUSTER, STEREO, SDO, Themis
  - Bepi Colombo, Solar Probe Plus, Proba-2

#### SUNRISE-2: a Solar balloon telescope:

- Solar telescope in the gondola of a stratospheric balloon
- With ist 1-m primary mirror the largest solar telescope so far to leave the ground, made in Germany+Spain; Gondola: US
- > Altitude of 37 km over Arctic Circle: UV, no seeing, no night
- Simultaneous observations of 2 science instruments:
  - SuFI: UV filter imager, 200-400nm (Gandorfer et al., 2011)
  - IMaX: Vector-Magnetograph, Fel 525.02 nm (Martinez Pillet, 11)
- 1<sup>st</sup> science flight in June 2009 (solar activity minimum)
- 2<sup>nd</sup> science flight in June 2013 high solar activity (MinMax)





#### First High-Resolution Images in the 279 nm Mg Line

- Good knowledge of chromosphere essential to understand how the outer solar corona is heated
- Solar structures look similar in Ca and Mg images
- Contrast of Bright Points in Mg much higher than at other wavelengths
- Structures in Mg images appear more smeared and smoothed than in Ca



## **Kilo Gauss Fields Resolved**

- Kilo Gauss fields assumed for magnetic bright points since invention of line-ratio method (Stenflo, 1973)
- Inversions of Sunrise data give:
  - kilo Gauss fields without the need to introduce magnetic filling factor
  - temperature enhancement that agrees with empirical flux-tube models

Sunrise finally resolved magnetic bright points even in the quiet Sun



# Sunrise-2: Bright Point contrasts

- First measurements of BP contrasts in the UV
- Higher contrasts and broader contrast distributions at shorter wavelengths



High BP contrasts confirm assumption that BPs are important for irradiance variantions in the UV (and possibly for the climate)

# **Solar Orbiter**

- Objectives: Observation of the Sun from the photosphere to the solar wind
- Launch scheduled for July 2017
- Nom. Mission Operations mid 2027 (incl. transfer)
- As close to the Sun as 0,28 AU, up to 34° inclination
- Payload suite consisting of 10 remote-sensing and in-situ-instruments
- Selected German Instrumentation:
  - Polarimetric and Helioseismic Imager (PHI, MPS)
  - parts of Energetic Particle Detector (EPD, Univ. Kiel)
  - parts of EUV-Imager, EUV-Spectrometer, Coronograph (EUI, SPICE, METIS ; all MPS)
  - parts of Spectrometer Telescope Imaging X-rays (STIX, AIP)





## **Solar Orbiter - German contributions 1**



# **Solar Orbiter - German contributions 2**



Co-PI: Dr. U. Schühle (MPS), Dr. L. Teriaca (MPS)

HRI Lyman-alpha Telescope

Co-I: Dr. U. Schühle (MPS)

Primary Mirror and Mirror Coating

Co-I: Prof. S. Solanki, Dr. L. Teriaca (MPS)

Image Sensor and Read-out electronics for the UV-Sensor

## **More German Contributions to ILWS**

- · On-Going participation to missions in Orbit
  - SOHO (several instruments)
  - Cluster (several instruments)
  - STEREO (instrument parts)
  - SDO (local data center)
  - Themis/Artemis (magnetometers)
- Instrument development and mission preparation
  - BepiColombo (magnetometer)
  - Solar Probe Plus (Software development for WISPR)
  - Proba-2 (instrument parts)

#### **CGAUSS:** Coronagraphic German and US SolarProbePlus Survey = German Contribution to the Wide-field Imager for Solar Probe (WISPR) for the Solar Probe Plus Mission (NASA)



# **WISPR on Solar Probe Plus**

- Wide-Field Imagers of the Heliosphere (95° radial x 58° transverse, inner FOV limited to 13.5° from Sun center
- Visible Light Observations (~500-700 nm)
- Simple Telescopes: No Mechanisms Other Than One-Shot Door
- Next-Generation 2K x 2K APS Sensors

00:09 UT, 15 February 2008





# CGAUSS



5 00 um

**CGAUSS** Team

#### DLR-NASA (Implementing Arrangement): 03/2012-09/2026

#### Establishing the European SPP data archive



National Collaborators: Ralf Srama and Team @ Uni Stuttgart

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