Mechanical solutions for two advanced solar Bragg-reflection instruments: SolpeX and ChemiX

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Special thanks for Anetta Owczarek
Kortes will be pointed to the Sun only by 10-12 min/orbit.

Perigee 409 km
Apogee 416 km
Orbital inclination 51.65 degrees
Orbital period 92.69 minutes

Progress on EUV & X-ray spectroscopy and imaging II

Position of instrument Kortes
Progress on EUV & X-ray spectroscopy and imaging II
B-POL will be used to measure the degree of linear polarization of the soft X-ray radiation of solar flares.
B-POL (Bragg POLarimeter)

Instrument Dimensions

The total mass ~3kg
Detailed Construction of B-POL

CCD30-11 Back Illuminated

System Calibration Fe⁵⁵

Electronic plate

Entrance Capillary Mesh

Double WiFi system

Active pixels 1024 x 256
Pixel size 26 x 26 µm

Bent monocrystal wafer of large area 3 x 10 cm

Active pixels 4104 x 2048
Pixel size 15 x 15 µm

Precision rotation motor

Copper thermal strap

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Purposes of the Pinhole System/ CCD:
1. Locating the X-ray source on the Sun
2. Detecting active phenomena on the disk, analyzing individual lightcurves
3. Image readout: each 0.2 s

Purpose of the capillary colimator:
1. Selecting isolated active regions or flare
2. FOV: ~2 arcmin

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**Wireless Power Transfer System**

Maximum supply power is 5W.

1. 1- CCD
2. 6- Thermometers
3. 2- Wifi system
4. 1- Electronic plate

**Polarimeter B-POL**

Thermometers

1 RPS

Transmit coil

Receive coil

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The cooling system of the B-POL instrument

Currently, we make simulations in order to select the cooling system:

The first cooling system it’s rotation radiator.

The second cooling system is dual system to transfers the heat through graphite bronze bushing / graphite bearing and rotation radiator.

The third cooling system replaces cold finger for heat pipe.
The Interhelioprobe (IHP) Mission is among the most advanced astrophysical project of Russian space exploration program, the intention of which is to explore the space in the immediate vicinity of the Sun as close as ~60 solar radii. Such a close proximity of the vantage point will allow for the first time the solar surface to be observed with a spatial resolution ~4 times better than from 1 AU, and which is even more important, to measure fluxes of the solar radiation ~10 times stronger than at Earth.

Scientific instruments 160kg
The total mass of the satellite 1860kg
To be launched in 2025/2026
Progress on EUV & X-ray spectroscopy and imaging II
The temperature level varies widely depending on the orientation of the spacecraft (−100°C...+450°C)
Temperature shield

**Chemix entrance window**

Верхн экр макс - +428°C
Верхн экр мин - +379°C
Нижн экр макс - +382°C
Нижний экр мин - +266°C
Нижн экр ЭВТИ макс - +79.9°C
Нижн экр ЭВТИ мин - -28.1°C

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General view of the ChemiX Bragg spectrometer (right). The upper two panels are the filter boards to be mounted on the mission thermal screen. They have to withstand harsh thermal conditions (~400°C). The crystals and detectors are mounted within the block placed ~1m behind the filters. The red-capped tube is the particle detector system, under development by the Ukrainian Kharkiv group led by Dr. Dudnik.

1. Average power consumption of 10 W
2. Telemetry above 20 MB/day
3. The total mass of 6kg
Thermal shield and X-ray filters consisting of two sections (front and rear). The main function of these two layers is to block the thermal load of solar radiation on the instrument and prevent the heat to penetrate down to the S/C.
MB
Measurement Block

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Their main function of the capillary is to limit the field of view (FOV of ~3 arcmin2) of solar X-ray illumination.

The *pin-hole imager* with the aperture of the order of 1 mm² which projects the real-time X-ray solar image on the CCD.
Four sections of the spectrometer cover the spectral range from approx. 1.5 Å to 9 Å.
Dopplerometers System

Dopplerometer consist of three sections, each equipped with identical crystal strips with opposite sense of dispersion. These three sections will allow for precise measurements of emission line Doppler-shifts and profiles.

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Solar Flux at distance 60Rs is 17.5KW/m²

Solar Flux at distance 253Rs is 950W/m²
What has been done at this stage

We made and sent Cad documentation to Russian. Documentation was accepted by Russian part.
We performed the Vibration endurance test

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<th>Axis</th>
<th>Details</th>
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<tbody>
<tr>
<td>X</td>
<td>Frequency: 10 - 900 Hz, Acceleration: 0.6 - 4.0 g</td>
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<tr>
<td>Y</td>
<td>Frequency: 10 - 900 Hz, Acceleration: 0.6 - 4.0 g</td>
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<tr>
<td>Z</td>
<td>Frequency: 10 - 900 Hz, Acceleration: 0.6 - 4.0 g</td>
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<table>
<thead>
<tr>
<th>Frequency (Hz)</th>
<th>Acceleration (g)</th>
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<tbody>
<tr>
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<tr>
<td>60 - 80</td>
<td>1.0</td>
</tr>
<tr>
<td>80 - 200</td>
<td>1.0 - 3.0</td>
</tr>
<tr>
<td>200 - 900</td>
<td>3.0 - 4.0</td>
</tr>
<tr>
<td>900 - 2500</td>
<td>4.0</td>
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Progress on EUV & X-ray spectroscopy and imaging II
What has been done at this stage

We have made and sent to Russia two models. All models are made in flight version

Thermal model

Dimensional and Weight model

Progress on EUV & X-ray spectroscopy and imaging II
Thank you for your attention!