

HIRES UVB spectrograph

HIRES at AIP:

Klaus Strassmeier
Katja Poppenhaeger
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Joar Brynnel
+ more



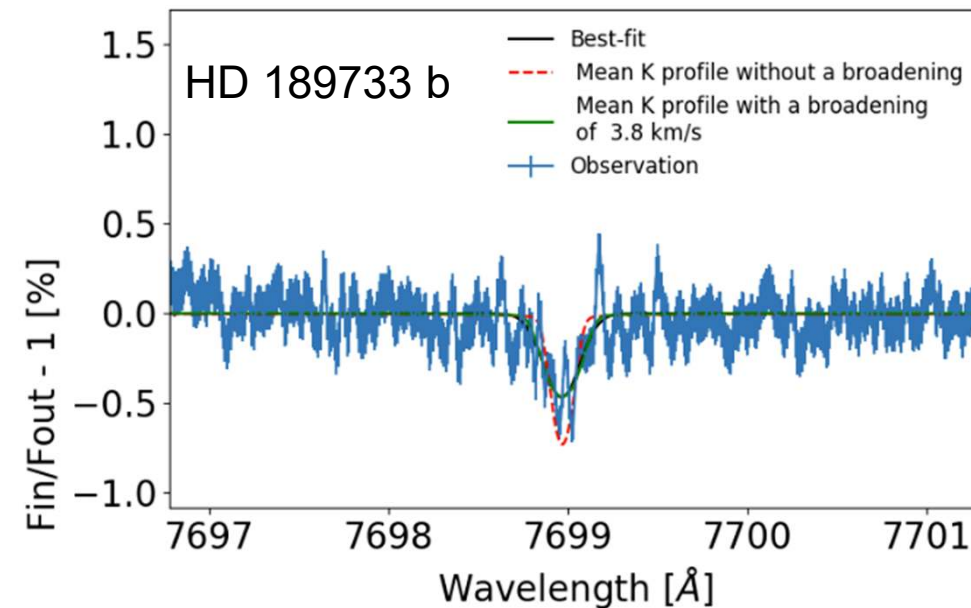
HIRES science at AIP

Exoplanets:

- high-resolution transmission spectroscopy
- current work: PEPSI high-res ($R=250\,000$) spectrograph at LBT/Arizona, developed and built at AIP



Keles et al. (2020)

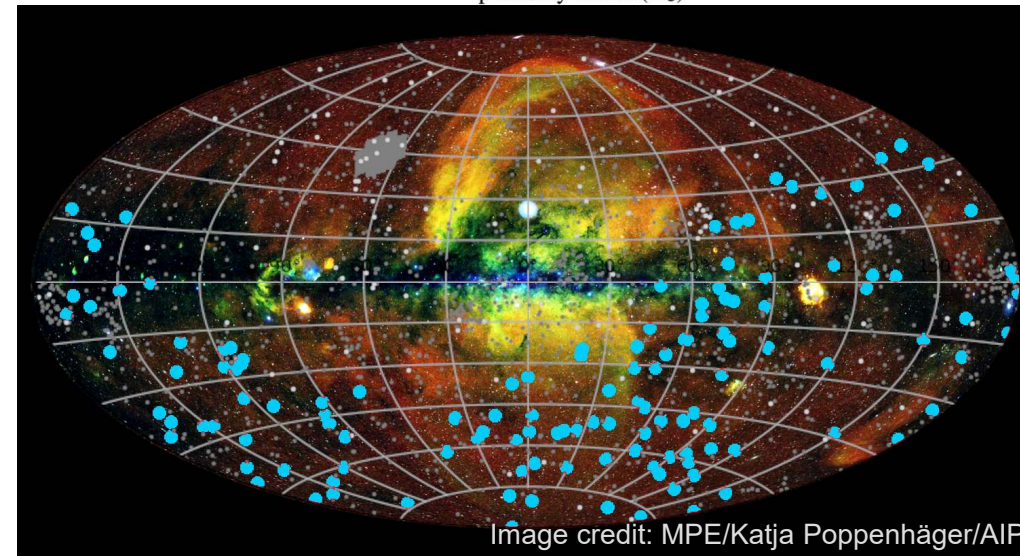
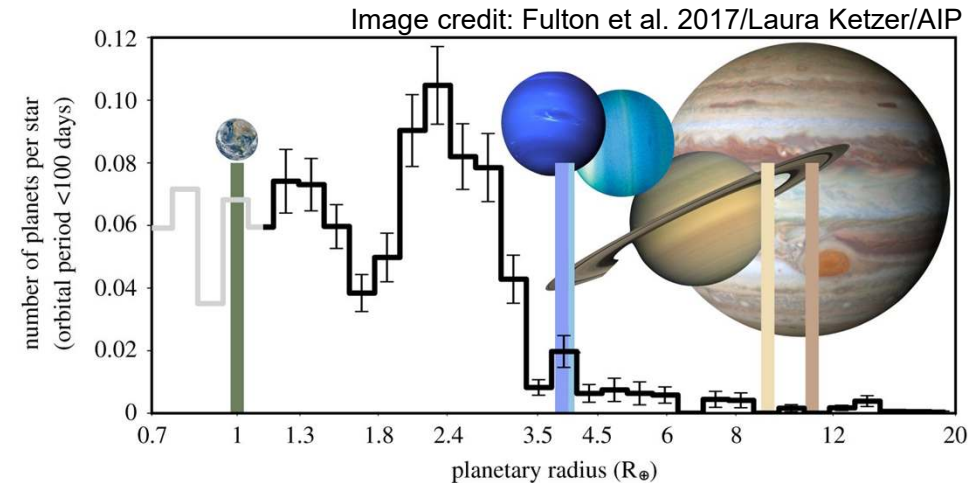


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Exoplanet evaporation:

- combination of high-energy observations of host stars with exoplanet atmosphere characterizations
- AIP is part of the German-Russian eROSITA X-ray mission

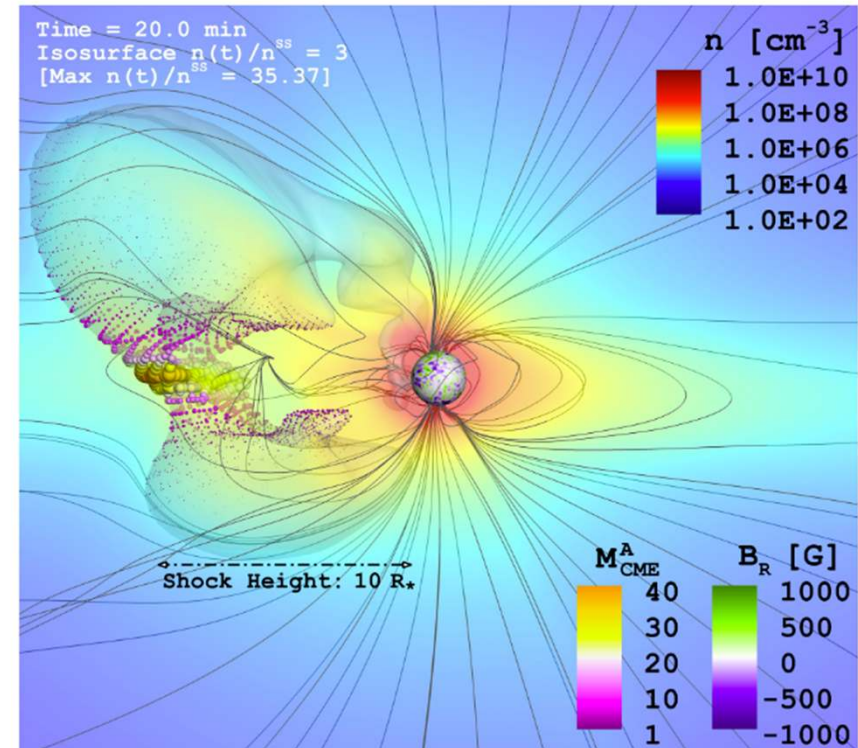
Poppenhaeger et al. (2021),
Foster et al. (2021)



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Star-Planet Interactions:

- interaction of stellar winds and coronal mass ejections with exoplanet atmospheres
- exoplanets influencing stellar magnetism/rotation?



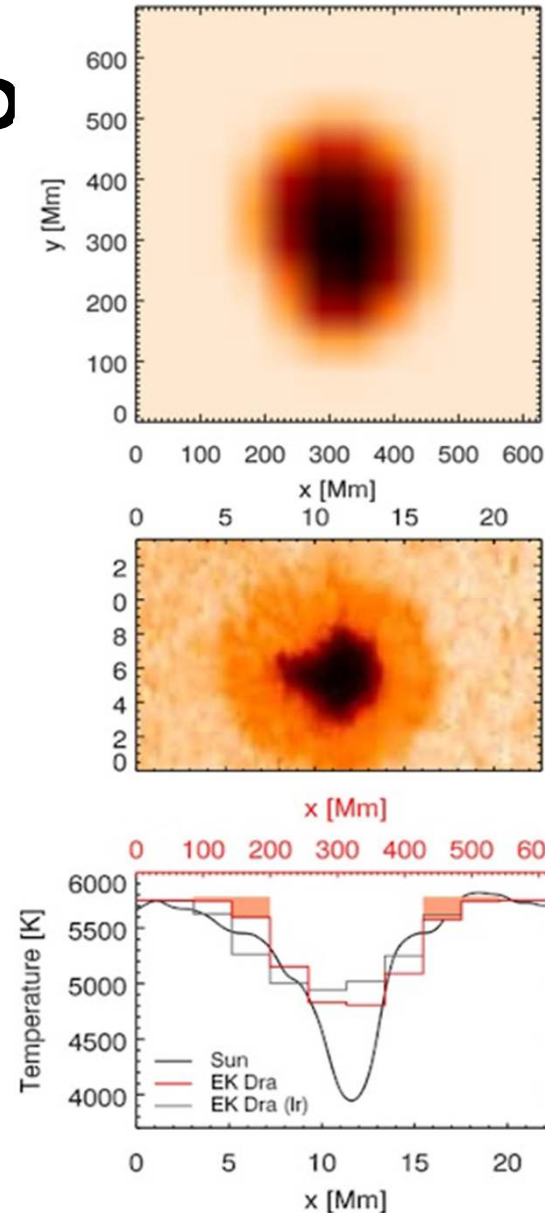
simulated CME on Proxima Cen,
Alvarado-Gomez et al. (2021)

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Stellar rotation and activity:

- Doppler Imaging: quantum jump from field stars to stars in open stellar clusters!
- current work: (Z)DI with PEPSI of field stars, solar twins at different ages

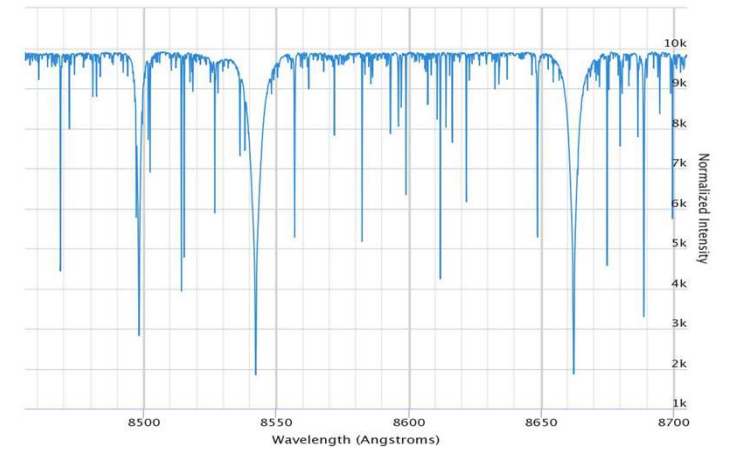
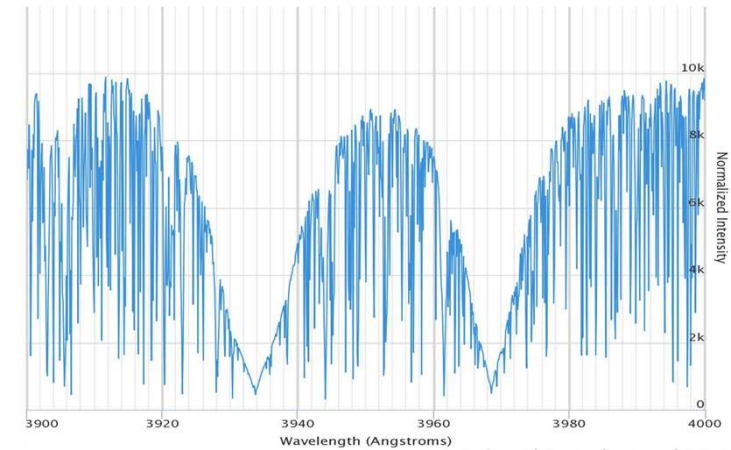
EK Dra starspot penumbra from Doppler Imaging,
Järvinen et al. (2019)



HIRES science at AIP

Stellar rotation and activity:

- stellar abundances, magnetism, line profiles
- Ca II H and K lines (3933 & 3968 Å) more sensitive to stellar activity than Ca IRT! Important for activity removal when studying small exoplanets.

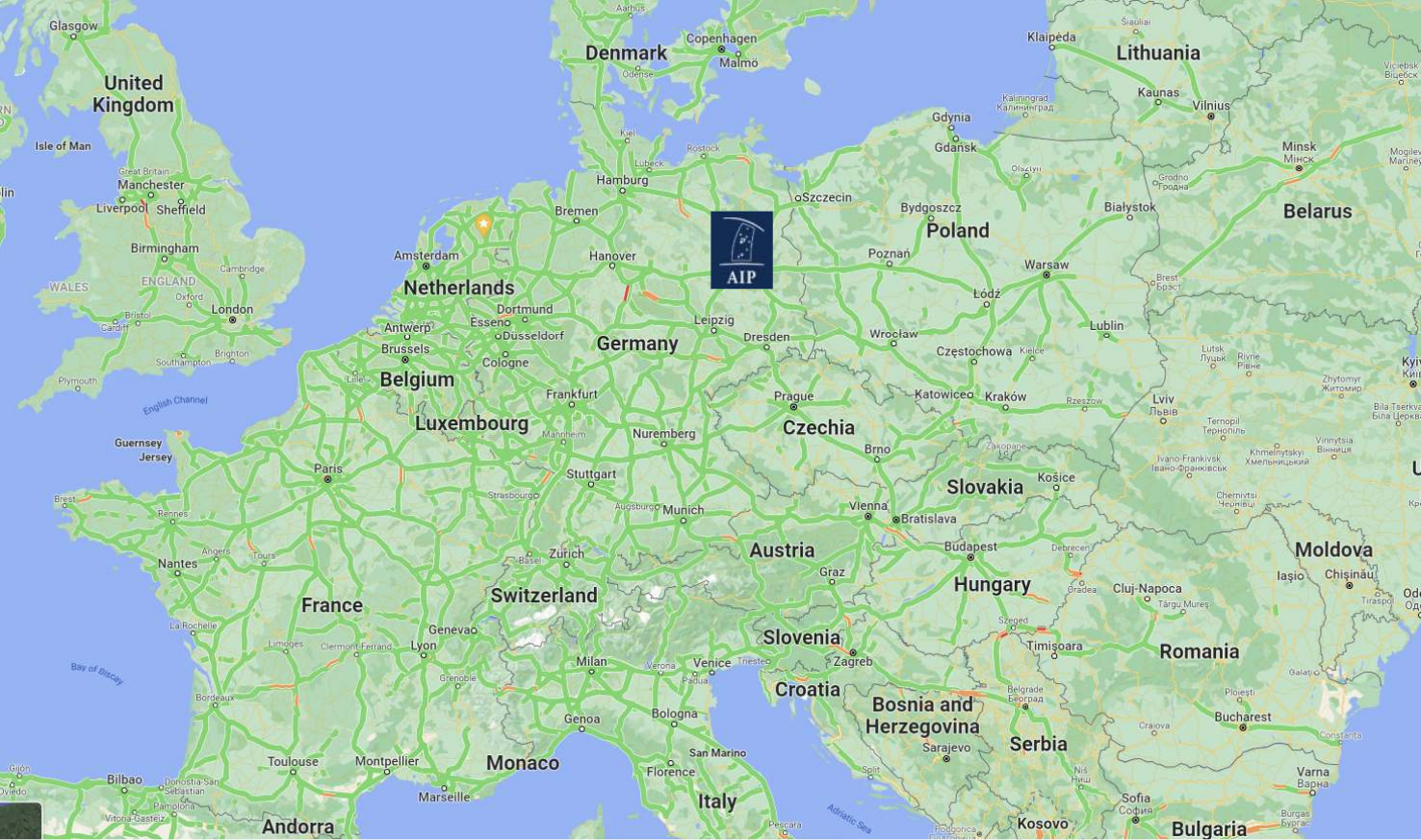


BASS2000 solar spectrum

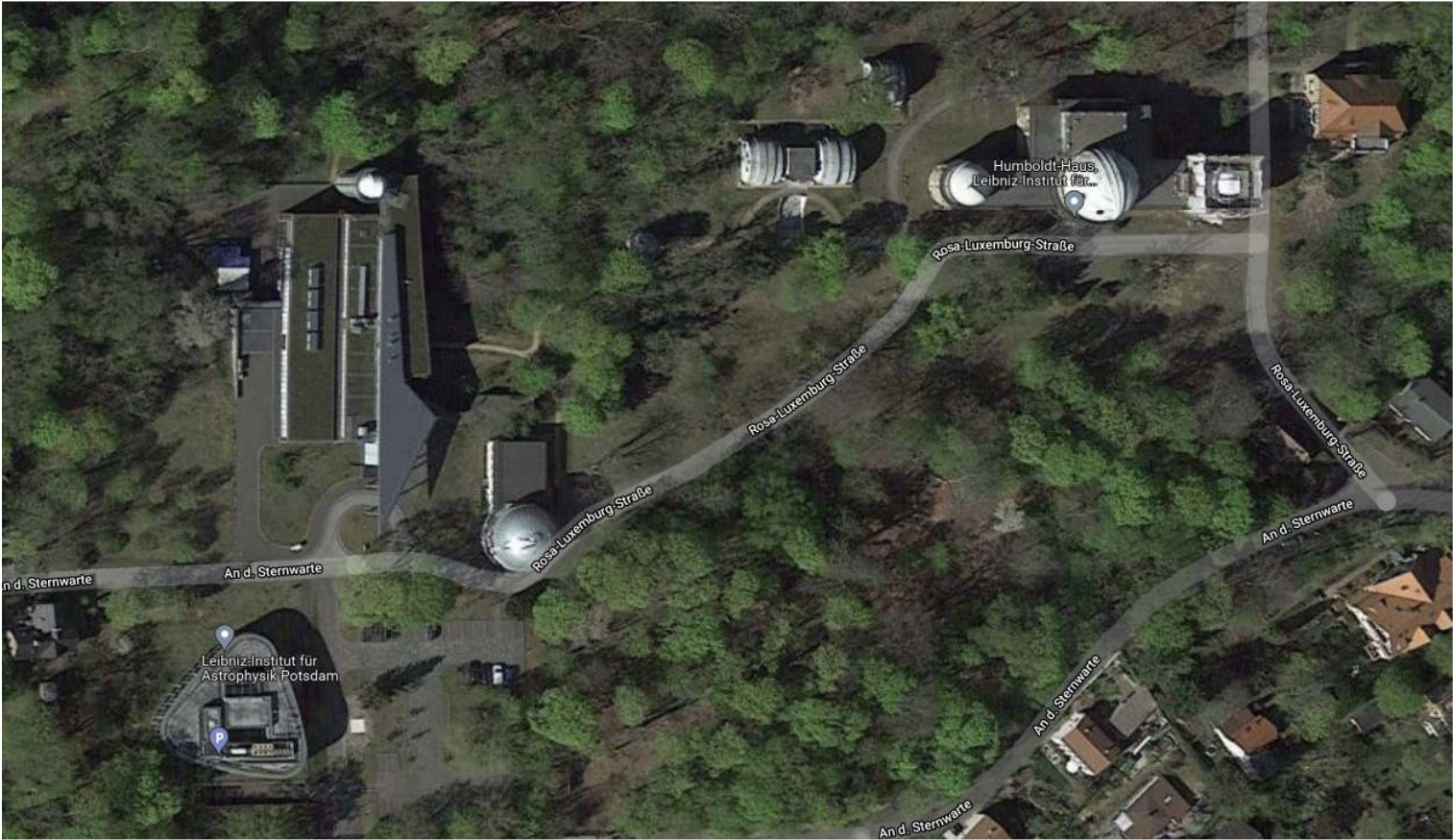
HIRES UVB Spectrograph

Project Management

AIP – the institute



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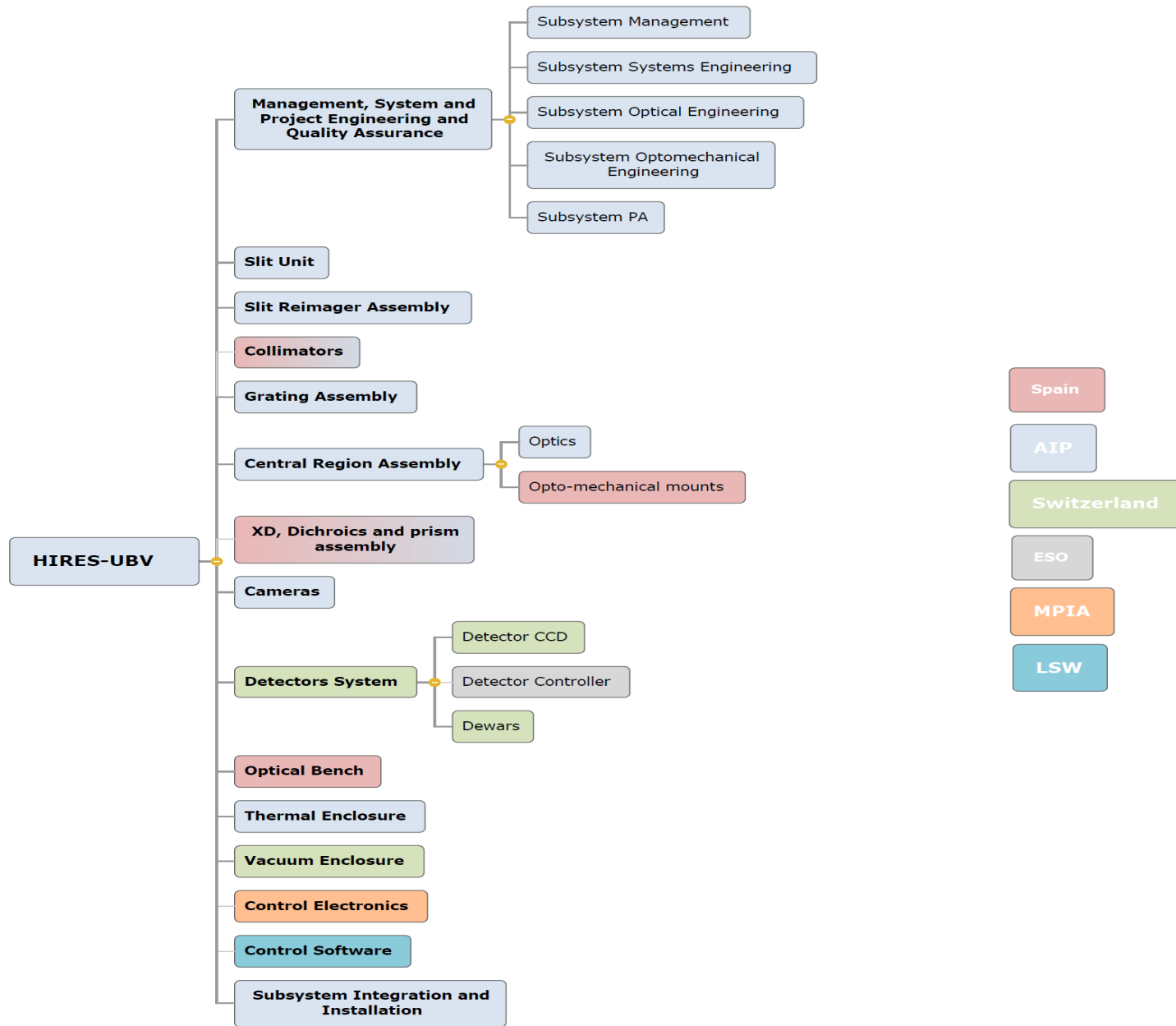
- About 200 staff
 - Predominately science
 - Instrumentation
- HIRES UVB spectrograph:
 - High-Resolution Spectroscopy and Polarimetry
 - Project Management
 - Technical Section
- Two large integration halls, Clean room, Climate chamber, Optics lab, Machine shop
- Experience with ESO projects and small to large instrument projects

The HIRES team at AIP

- SC: Katja Poppenhäger
- Board: Klaus Strassmeier
- Systems Design: Michael Weber
- Project Management: Joar Brynnel
- Project Management Support: TBC.
- Product Assurance: Domenico Giannone
- Instrument Scientist: Silva Järvinen
- Project Assistant: Katrin Böhrs
- Lead systems engineer: Olga Bellido
- Systems engineer: Jörg Weingrill
- Optics: Manfred Woche
- Optics: Daniel Sablowski
- Mechanical Engineer lead: TBC
- Mechanical Design: Frank Dionies
- Mechanical Design: Svend Bauer
- Detectors: Arto Järvinen

UBV Spectrograph numbers

- Cost estimate 8.1 M€
- FTE estimate 60
- Contributors D/SPA/CH + possibly DK



UBV Spectrograph planning (phase B)

- 2022:
 - 1 January: Phase B start
 - > *Requirements analysis*
 - 15 April: Optical design concept validation done
 - 1 June: Mechanical design concept validation done
 - > *Requirements to UBV subsystems*
- 2023:
 - Aug/Sept (TBC): PDR documentation package ready
 - Dec (TBC): PDR
- Prototyping during phase B: Grating mount

UBV Spectrograph planning (phase B)

Phase B is short!

We need to get started now!

Work based on existing opto-mechanical concept

Dependent on consortium partners

Need input from Project Office:

Requirements specification

Interface definitions

Scope of work

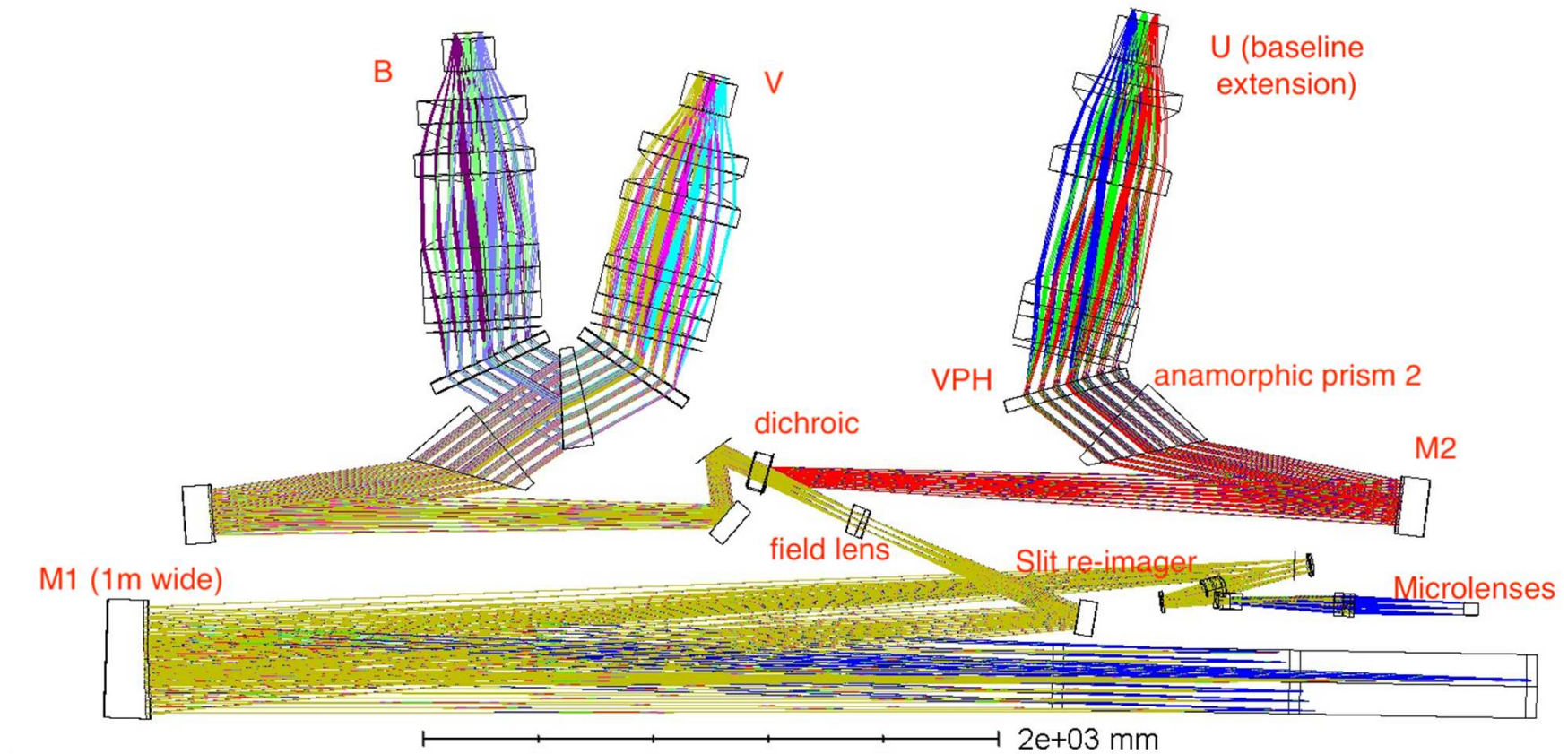
Project environment definitions

UBV optical design

Michael Weber & Manfred Woche, AIP

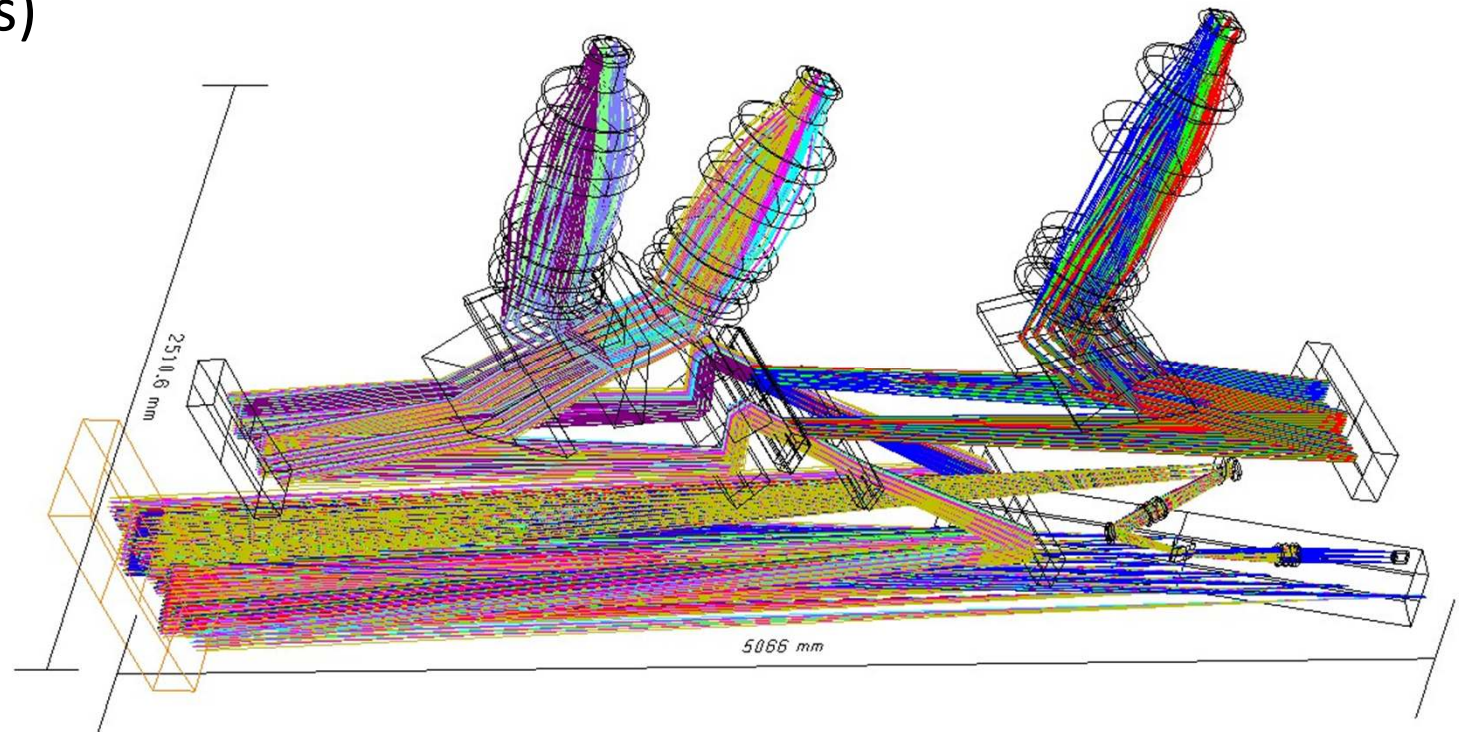
Thanks to T. Oliva & HIRES Consortium for Code-V files

Overview



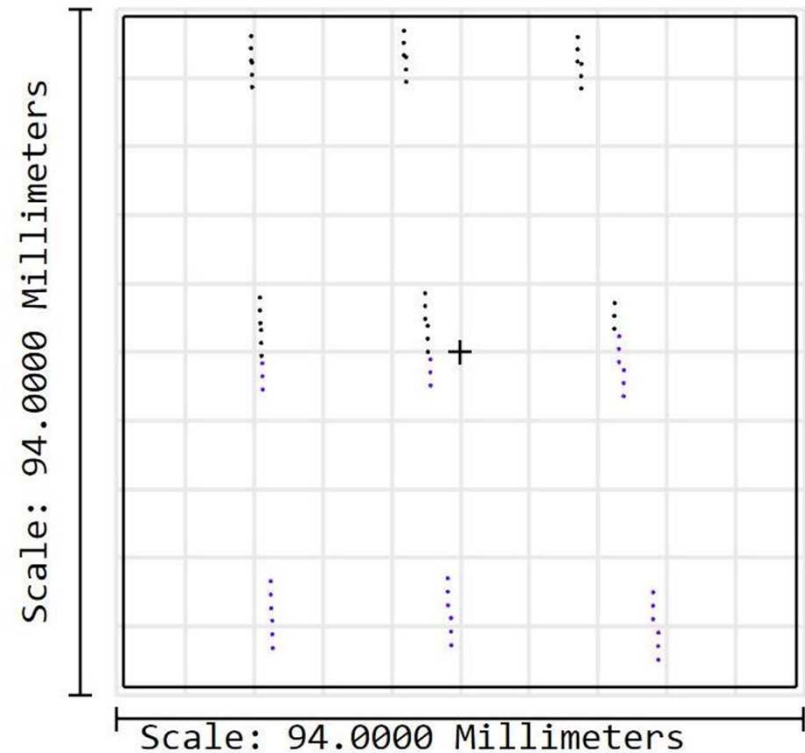
3D-view

- Size (just optics)
- 5m long
- 2.5m high
- 1m wide



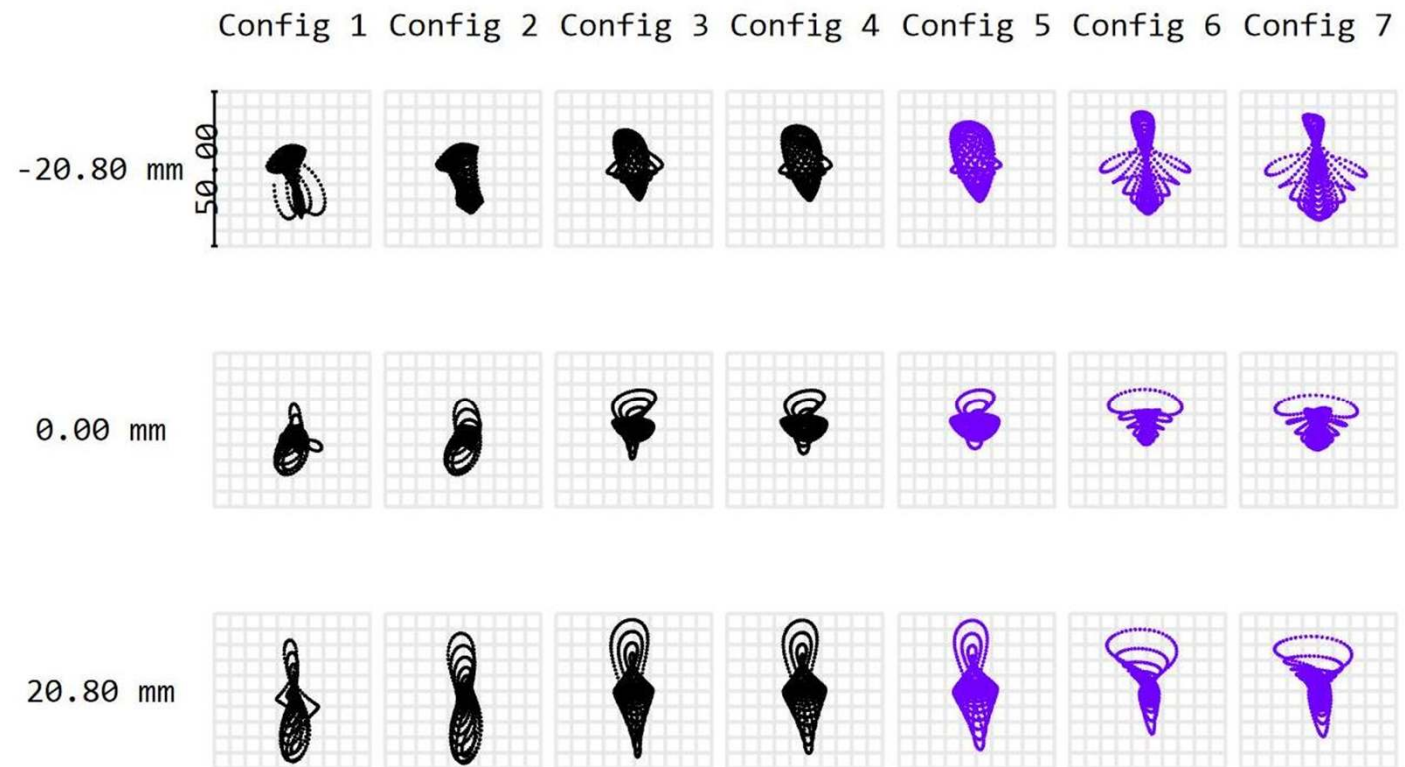
Footprint

- Spots at center and at +/- FSR
- Shown is U-band: 350 – 406nm, orders 133 – 115. Inter-order separation needs to be confirmed with actual slit geometry
- B-band: 402 – 496nm, 116 - 94
- V-band: 491-630nm, 95 – 74



Spot diagram (U-band, center of orders)

- Good performance already, small improvements necessary
- Need to homogenize image quality across CCD



Next steps

- Optimize image performance
- Image simulations to verify TLR (sampling, wavelength coverage, order separation) – we would like a realistic slit geometry for the high-accuracy modes for that
- -> SPIE

UBV Spectrograph - Summary

UBV team at AIP mostly in place

High priority to establish collaboration with UBV partners

The blue end of HIRES has lots of exciting information for stars and exoplanets (Ca II H&K, Rayleigh scattering in the blue, ...)

We are looking forward to build a truly blue optimised spectrograph without the tradeoffs we had to make in spectrographs covering UV through NIR.

Highly motivated and eager to get started!