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Future of UV astronomy in the UK

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Space Park Leicester

CENTENARY 1921 2021 CENTENARY

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Introduction

- UK plans for HWO
  - CASTOR as part of a roadmap to HWO

- SIRIUS EUV spectroscopy mission

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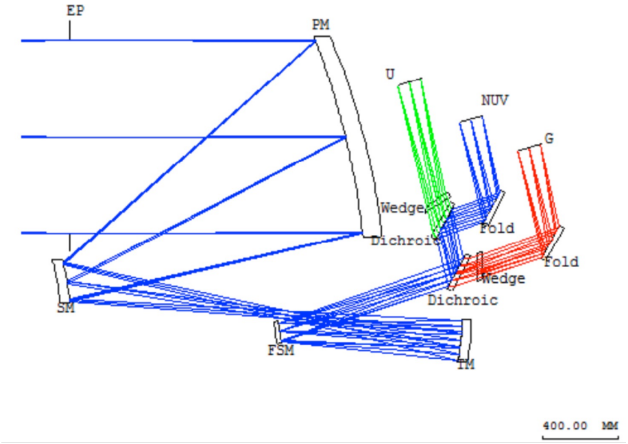
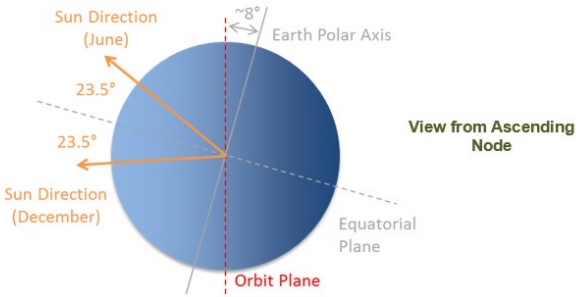
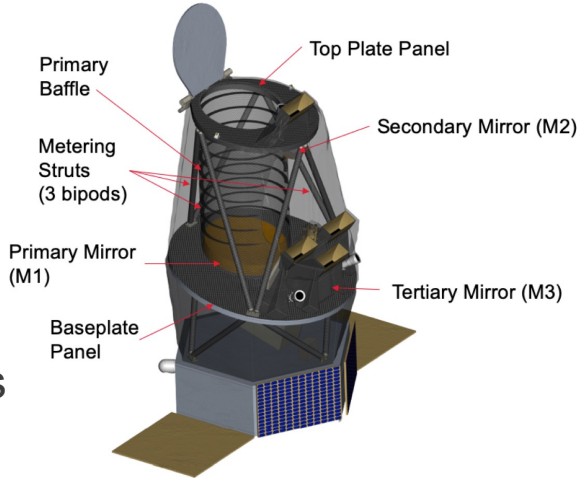
Castor





- Mission Design
  - 1m telescope, 0.25 sq deg fov, 1063 kg spacecraft, electric propulsion, 10 Gbps optical downlink
  - 800 km polar-terminator, LEO efficient survey of Euclid-Wide, LSST-WFD & Roman-HLS fields
  - Nominal 5-year mission (10-year goal) with both legacy surveys and GO programmes.
- UK role (OU/UoL) on CMOS detectors and electronics
  - UKSA bilateral funding



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Habitable Worlds Observatory

- Space funding in the UK
  - Science & Technology Facilities Council – basic instrument development and astronomy exploitation
  - UK Space Agency – higher TRL instrument development, instruments and mission implementation
  - Limited funding for mission development

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Habitable Worlds Observatory

- UK Space Agency in extensive discussions with NASA
  - Want to support early development of HWO involvement
  - Investment in CASTOR supports routes for instrument involvement
  - e2v as supplier of choice for most astronomical sensors
  - Participation likely via ESA, could be MIRI-type model
- STFC provided financial support for UK HWO community development
  - UK HWO workshop at Space Park Leicester, November 8th
  - https://www.eventbrite.co.uk/e/habitable-worlds-observatory-uk-community-workshop-tickets-715203933217?aff=oddtdtcreator

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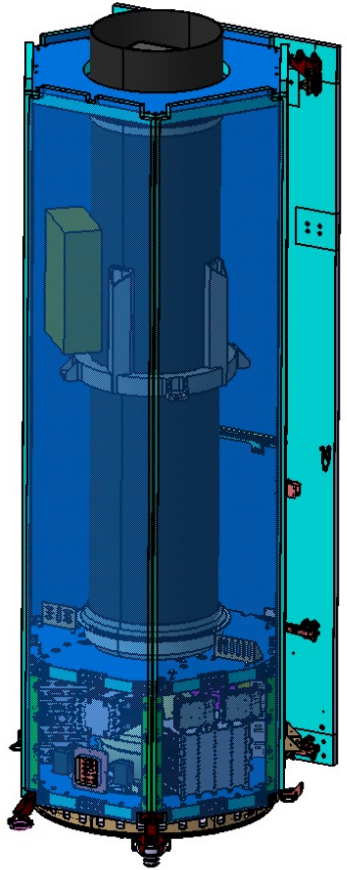
SIRIUS: Observatory-class facility in a small mission

C. Argiroffi, M. d'Avillez, N.J. Bannister, J.K. Barstow, M.R. Burleigh, S.L. Casewell , S. Diebold, J.J. Drake, A.I. Gomez de Castro, M. Gillon, R. de Grijs, L. Harra, G.M. Harper, A. Hermans, L. Jacques, C. Kintziger, R. Lallement, J.S. Lapington, D. de Martino, Y. Naze, J. Nichols, I. Pagano, S.P. Quanz, R. Speight, B. Stelzer, B.Y. Welsh, K. Werner, A. Youngblood, G. Del Zanna.



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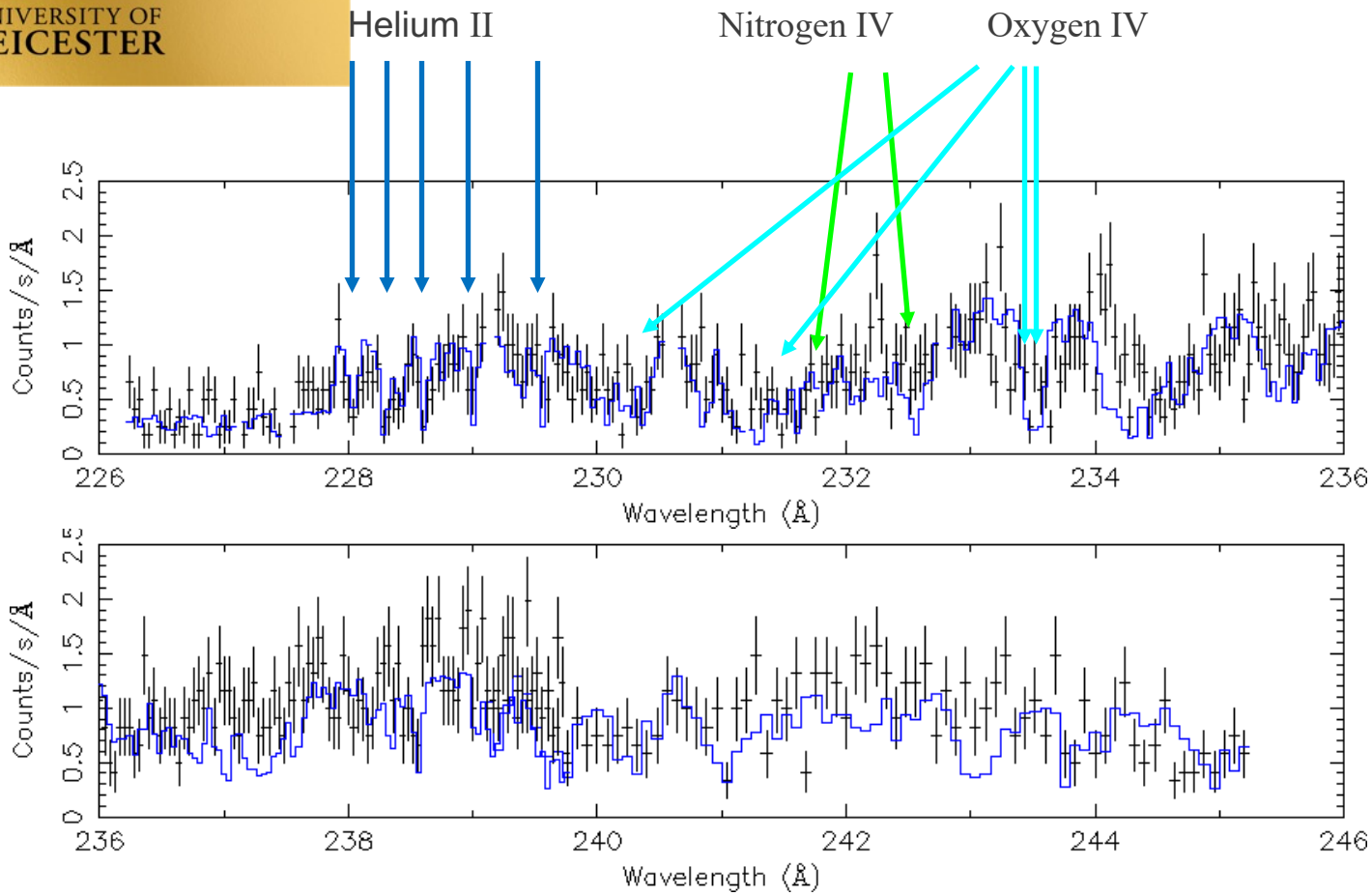
History

- Developed as part of J-PEX sounding rocket programme
  - Flights 2000, 2002 & 2008
- Various proposals to NASA SMEX/MIDEX programmes
  - Seen as too niche for scale of missions ($100-250)
- Proposed to ESA S- and F- calls
  - Favourably reviewed, but lost out to Cheops, SMILE, Comet Interceptor
  - Some political elements in selection processes

300s exposure of G191-B2B



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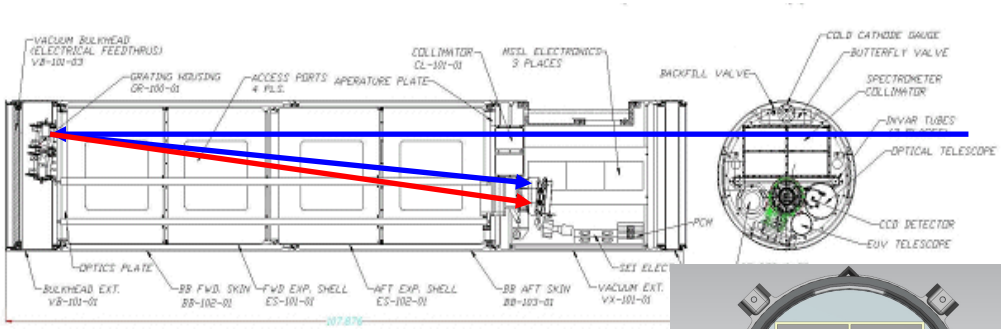
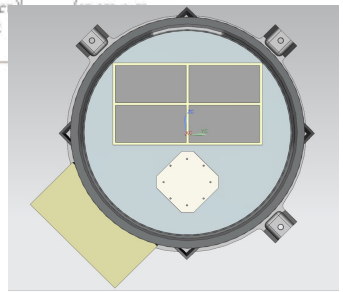
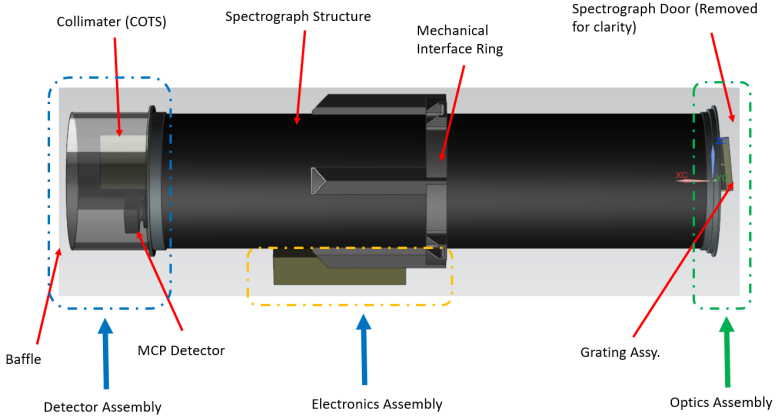
SIRIUS mission

- Innovative technology - high performance in a small mission
  - Sub-orbital demonstration
- Completely new capability in a poorly explored wavelength range
- Cutting edge science - cannot be delivered by any other mission
- Contextual and supporting data to complement and enhance other ESA missions (e.g. JWST, PLATO, Ariel)







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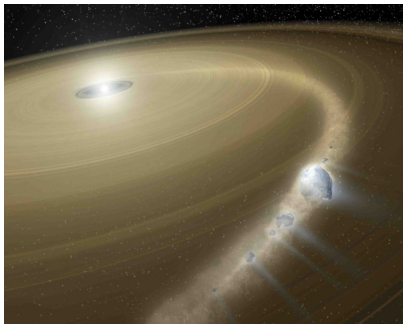
Stellar & Galactic Environment

- Structure & Dynamics of Stellar Coronae
  - Coronal heating, activity & flares – Solar quality data for nearby stars
  - Exoplanet environments
- Evolution of White Dwarfs
  - Atmospheric composition & structure
  - Extrasolar planetary debris
- Structure & Ionization of the Local Interstellar Gas
  - Can only be directly measured in the EUV
- Extra-galactic observations in low density regions



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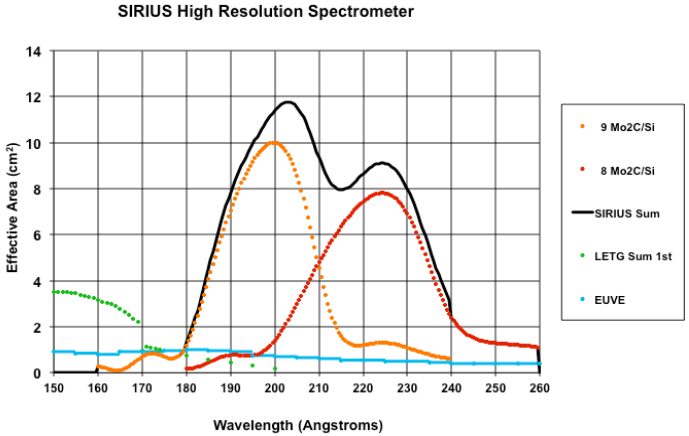
Implementation



- Instrument – slitless, normal incidence off-axis EUV spectrograph
  - R~5000, peak A_{eff} > 10 cm^2, λλ 180 - 240 Å
  - Four gratings tuned in pairs to two bands: 180 - 220 Å and 200 - 240 Å - Key coronal and transition region lines, HeII Lyman line series, WD photospheric continua
- Science goal – survey of stellar and galactic environments
- Programme – observations of ~100 stellar sources in 3 years, including long term monitoring of a subsample

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Status

- Highly rated in recent ESA F2 competition (€150M)
  - Arrakhis selected with SIRIUS as back-up (still), but no study
- Highly rated by UKSA
  - Working on bi-lateral mission (end 2023)
  - Key need is to lower costs
  - Added industry partners
    - In-Space (spacecraft), Oxford Space Systems (deployable structure)
  - Instrument consortium remains in place