'Future Space Opportunities (NewMissions)' Abstracts

Talks

Farside Interferometry Occultation Radio Experiment (FIORE)

Authors

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Abstract

The Farside Interferometry Occultation Radio Experiment (FIORE) will use two-point (lander-rover) radio-frequency measurements on the far side of the Moon to achieve two complementary science investigations using Radio Occultation Interferometry (ROI) and Ground Penetrating Radar (GPR).
1. Map the structure and spectrum of the low frequency (<50 MHz) sky for the first time. This includes mapping the free-free absorption (thermal electron population) in the galactic plane - leading to a deeper understanding of the thermal electron and cosmic ray electron populations in the galaxy. Measuring the low frequency (<10 MHz) sky, not visible through the Earth's ionosphere, allows the first observations of the structure of the galaxy and discrete sources such as supernova remnants. The radio observations will also measure the dynamic and variable Solar corona, including solar radio bursts caused by solar flares, and the auroral radio signatures of Jupiter, Saturn, Uranus and Neptune.
2. Probe the uppermost lunar crust to the megaregolith boundary region. This includes measuring the thickness of the surficial regolith, determining the structure of the upper megaregolith, and determining the abundance of subwavelength scatterers. These observations will allow a better understanding of the history of bombardment of the Moon and how impacts have created structure in the crust.
FIORE is proposed to the NASA Payloads and Research Investigations on the Surface of the Moon (PRISM) on the Commercial Lunar Payload Services (CLPS) for launch to the Moon in 2030 or 2031. The mission concept is led by Stuart Bale from the University of California Berkeley and incorporates two Free-space Optical Communication Unit for Space (FOCUS) terminals from the University of Northumbria, UK, to provide a high-throughput data connection between a lunar lander and rover. The UK science involvement in the mission includes GPR, radio astronomy, solar physics and outer planet magnetospheres. FIORE thus covers a very wide remit of internationally leading science. The FIORE UK team is actively

searching for UK academics interested in any aspect of the mission science return to join our team.

The Probe Far-Infrared Mission for Astrophysics: PRIMA (Invited)

Authors
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Abstract
PRIMA is a candidate NASA astrophysics probe class mission with significant UK involvement which has just completed Phase-A study and is awaiting an imminent selection decision from NASA.

The PI science programme has three themes: the Origin of Planets and their Atmospheres; the Co-Evolution of Galaxies and Supermassive Black Holes Since Cosmic Noon; and the Buildup of Dust and Metals. The bulk of the observing time on PRIMA would be made available to the community through a General Observer (GO) program offering 75% of the mission time over 5 years and two volumes of GO programmes containing 196 projects have been generated by the community.

PRIMA is a 1.8-m diameter, cryogenically-cooled to 4.5 K, far-infrared observatory concept for the community in the 2030 decade. PRIMA includes both a sensitive wideband spectrometer FIRESS, and a multi-band spectrophotometric imager / polarimeter PRIMAger. Both instruments use detectors limited by the natural background, and PRIMA's sensitivity unlocks the potential of the far-IR waveband to advance astrophysics across a broad range of topics spanning from galaxy and dust evolution in the early universe to the formation of planets and planetary atmospheres.

FIRESS offers full-band instantaneous coverage from 24 to 235 μm in two modes. The low-res mode offers R~100 with long slits, while the high-resolution mode offers R up to 4,400 × (112 μm / λ) in smaller fields. PRIMAger offers rapid R=10 hyperspectral imaging with continuous coverage from 25 to 84 μm, and imaging polarimetry in 4 bands from 90 to 235 μm.

The NESST (North-East Space Skills and Technology) Facility: The who what when where and why

Authors

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Abstract

The North East Space Skills and Technology (NESST) facility at Northumbria University, Newcastle upon Tyne, is a newly established academic–industry hub designed to advance small satellite engineering, space instrumentation, space weather reseearch and optical communications research. NESST provides integrated capabilities for satellite Assembly, Integration and Test (AIT), including cleanroom environments, environmental testing (thermal vacuum, vibration, and EMC), and specialist laboratories for laser communication systems and space payload development. The facility set to open its doors in October 2026 is a regional hub, with national partners spanning academia, industry, and UK Space Agency. I has been funded under the UK Space Agency Space Clusters Infrastructure Fund (SCIF), it's primary focus is to support the development and qualification of next-generation space technologies, paving the way for new scientific discovery, training the next generation of space technologists. NESST is being deployed at a critical time of rapid growth in the global space sector and increasing demand for sovereign UK capability in satellite manufacturing and space-enabled services. The facility addresses a clear skills and infrastructure gap in the North-East by providing hands-on training, research opportunities, and direct industry engagement for students and researchers. By enabling end-to-end mission development, from concept through to environmental qualification, NESST aims to accelerate innovation, strengthen regional economic growth, and position the UK as a leader in resilient, high-performance space systems.

The ALIGN (Autonomous Laser Intersatellite Gigabit Network) mission: enabling space science discovery with disruptive space technology

Authors

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Abstract

The ALIGN (Autonomous Laser Intersatellite Gigabit Network) mission is a UK Space Agency–supported mission developing the FOCUS (Free-space Optical Communications Unit for Satellites) payload: a compact, high-performance optical terminal enabling autonomous, high-rate intersatellite links in Low Earth Orbit. FOCUS targets data rates exceeding 1 Gbps over >1000 km, within a CubeSat-compatible envelope (<4 kg, <50 W, ~3U), integrating co-aligned acquisition and communication through a novel PSD/APD detector architecture and nested optical paths for rapid link establishment and fine pointing control. This capability enables a step change in distributed space science capability. FOCUS could support precision cluster alignment for formation flying, facilitating missions in laser interferometry and space-based coronography, where sub-arcsecond stability and high data throughput are critical. It also enables near-real-time data exchange for lunar relay architectures and in-situ active plasma experiments in LEO, where coordinated multi-point measurements are essential. FOCUS therefore provides a scalable, low-SWaP solution for next-generation, networked space science missions.

A space-based radio interferometer enabled by ultrafast optical links

Authors

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Abstract

Radio interferometry enabled the first high-resolution studies of the Universe, and is made relatively simple by powerful computing. By combining the signals from individual detector elements, an effective aperture much larger and more sensitive than the individual elements can be synthesized. In fact, digitised signals can be recorded at each element, and then transmitted to and correlated at a convenient central location to produce images and spectra. In principle, chosen pointings on the sky can be imaged at chosen frequencies and spectral and spectral resolutions at chosen times from archived data; however, the data rate required from each element of the interferometer is very great, and for high-quality imaging a large number of antennas are required. The forthcoming international Square-Kilometer Array (SKA) has assembled a comprehensive and convincing science case for continuing to develop the capabilities of radio interferometers, with the precursor instruments in South Africa and Australia supporting its development. Alongside the upgraded LOFAR, the Deep Synoptic Array (DSA) and Next-Generation Very Large Array (ngVLA) provide competition and complementarity in the northern hemisphere. Current interferometers require optical-fibre links between each individual antenna element and the correlator in order to reach the required data rate, and thus they require fixed and expensive infrastructure to be emplaced in austere environments. In constrast, the separation of free-flying antennas in space can be arbitrarily large, and free-space optical links are capable of carrying the amount of data required, if appropriate innovations in these relatively novel systems are made. I will describe a conceptual scheme for constructing a solar-system scale interferometer, which can potentially operate from MHz to THz frequencies, and deliver extremely high spatial, spectral and time resolution. While a $10bn-class project, the optical links that must be developed in order to make the system practical could potentially revolutionise intercontinental data transmission on Earth, making undersea cables obsolete. If operating as a phased array, the instrument would replace Deep Space Networks. It would allow effectively unlimited data rates from planetary missions, enabling real-time high-definition video from the outer solar system without compression. If hundred-ton class spacecraft are to routinely fly to Mars in the next few decades, then deployment of such an array could be relatively inexpensive, and the communication infrastructure that is necessary to operate the array for science would also enable ultra-high-speed internet links around the solar system. Since everything seems to need an acronym, two come to mind: SOHARRA, Solar-Orbiting High-Angular-Resolution Radio Array; and DOHRAYME, Deep-Space Orbital High-Resolution ArraY between Mars and Earth.

Future Space Science and Exploration Missions enabled by Low-Cost SSTL Small Satellites

Authors

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Abstract

SSTL is playing a key role in supporting and/or developing a number of exciting future Space Science and Exploration Missions that can enabled by low-cost Small Satellites, including supporting a number of recent ESA Mini-F Phase 1 proposals, UKSA early phase studies, UKSA Space Frontiers 2035 white papers, as well as other internal developments. This includes a diverse range of Lunar science and exploration missions (e.g. LIRIS, CosmoCube and VOLARE), Astronomy missions (e.g. SuperASTRO), and Space Weather missions (e.g. UK-ODESSI). Many of these developments were presented at last years NAM2025 to give an initial overview of these mission concepts.

This has shown that early collaboration between industry and academia is essential so that mission concepts can be significantly strengthened, giving proposals a greater edge for e.g. ESA and bilateral mission concepts and subsequent mission phases (Phase A and beyond). Partnering with academia from the outset, especially in precursor UKSA Phase 0 studies, also ensures a balanced approach to science goals, engineering feasibility, and affordability—particularly for lower-cost missions like Mini-F and bilateral projects. This early alignment is crucial for developing rapid, cost-effective missions that can go from concept to launch within just five years.

This paper will provide more insight on the progress of these low cost yet high value SSTL mission concepts using small spacecraft for future Space Science and Exploration missions, and for diverse range of customers such as ESA, UK bilaterals or even more commercial entities. We will also discuss why early collaboration between industry and academia is essential to develop these concepts, ideally with UKSA early phase funding to underpin the concept feasibility.

Blue Skies Space – a new model for the future of space-based research data

Authors

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Abstract

Blue Skies Space has developed an innovative funding and delivery model for science satellites. This new model leverages recent advancements in space technology and the rapidly evolving global scientific landscape, enabling us to drastically reduce satellite development time and costs. Our vision is to accelerate and expand the availability of new datasets to researchers worldwide through a fleet of satellites, complementing the facilities delivered by space agencies.

Our first satellite, Mauve, was launched on 28 November 2025 into a Sun-synchronous 510 km orbit and carries a 13-cm telescope and a UV–visible spectrometer operating from 200–700 nm to monitor stellar magnetic activity and variability. During the early science phase, Mauve observed multiple targets to characterise performance and understand the feasibility of the different science themes proposed by the consortium members.

Mauve will run a collaborative three-year survey programme and provide thousands of hours of observations of bright stars to help answer questions about stellar activity and variability, exoplanet hosts, hot stars, exotic populations in binaries, and star-planet interaction. In this talk we will also explore how the wider research community can access Mauve year one data and identify opportunities to help develop the survey programme for years 2 and 3.

Blue Skies Space also has plans to develop a larger UV telescope and is working on a project to design a fleet of CubeSats in Lunar orbit for radio astronomy. In this presentation, we will outline how our approach is set to increase global access to valuable scientific data. Additionally, it will introduce the goals and design of both missions and highlight how their datasets will enhance and support ongoing and forthcoming astronomical facilities through monitoring, pathfinding observations, and targeted follow-up.

Line Emission Terahertz Observatory (LETO): exploring the origin of water and the lifecycle of the ISM in the Universe

Authors

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Abstract

The InterStellar Medium (ISM) is the reservoir of baryonic matter from which stars and planetary systems are formed. Also it is the repository of the material that is expelled at the end of the stellar evolutionary cycle feeding the baryonic matter reservoir. These evolutionary phase in the ISM together form a complex interplay driving planet and star formation and thus the evolution of our own Milky Way as well as galaxies at low and high redshifts. Line Emission Terahertz Observatory (LETO) is designed to pin down that interrelation between stars and the Interstellar Medium (ISM) in much more detail than was possible ever before, by providing the capabilities to obtain extremely sensitive and high resolution spectroscopic measurements in key Far-Infrared (FIR) molecular and atomic transitions.

LETO's design has been uniquely optimized to investigate the impact of the ISM on star formation on galactic and extragalactic scales, to study the processes that transform gas clouds into stars and planetary systems, and to trace the flow of water in the ISM, from galaxies to star-forming cores to planets and beyond. To achieve these goals, LETO will carry out deep velocity-resolved (3-Dimensional) wide-area surveys spectroscopic observations of key FIR lines in the ISM covering an area of approximately ~900 square degrees of the Galactic Plane. To complement our local view with earlier phases of cosmic evolution LETO will map a large sample of about 300 nearby galaxies, and carry out blind surveys in dedicated fields to study more distant galaxies. To shed light on the planet formation process, LETO will study the physical and chemical properties (especially gas mass) of previously known and newly discovered proto-planetary disks and stellar cores through e.g. pointed observations of the HD and H2O lines towards these sources.

LETO is a powerful Far-Infrared mission building on rich European heritage (Herschel/HIFI, GUSTO). To satisfy the requirements for sensitivity, resolving power and mapping speed, LETO will utilise a ~3m class mirror and several bands with sensitive state-of-the-art multi-pixel heterodyne arrays. The bands together will cover a wide wavelength range (56-666mm) and with the heterodyne receivers and backends high resolving power (R>106) spectroscopy a set of key FIR atomic, ionic, and molecular lines can be studied in great detail. The wavelength bands are chosen such that they will include the two main HD transitions as well as a large suite of gas phase water lines. The mission is one of several selected for further study in the context of the ESA M8 call.

The need for dual hemisphere auroral imaging from space

Authors

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Abstract

The aurorae provide us with important information that allows us to study key processes taking place within the magnetosphere, including solar wind–magnetosphere–ionosphere (SW–M–I) coupling processes. It has often been assumed in this context that the Northern and Southern Hemispheres are mirror images of one another (Hatch et al., 2022). This assumption is difficult to test rigorously without simultaneous conjugate datasets. It was not until over a century had passed since the first studies into the aurora that it was categorically demonstrated to be untrue in the first conjugate observations of the aurora borealis and australis (Laundal & Østgaard, 2009). External and internal factors driving the system are asymmetric all or most of the time, but our understanding of the extent of inter-hemispheric asymmetries and their driving mechanisms is poor, due to extremely limited conjugate observations. The best way to examine these asymmetries in the system is through global auroral imaging of both hemispheres. The aurora can then be used as a diagnostic for the entire SW–M–I system, improving our fundamental understanding of the coupled SW–M–I system. This improved understanding will also have important societal benefits, for example, by enabling better space weather prediction capabilities, which are becoming increasingly important with our rapidly expanding use of near-Earth space.

Revealing the Cosmic Dark Ages from lunar orbit with CosmoCube

Authors

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Abstract

The Cosmic Dark Ages are a crucial period in cosmic history, corresponding to redshift z ~ 30 - 250, before the formation of the first stars and galaxies. During this epoch the universe transitioned from a largely homogenous state to one rich in structure. However, the Dark Ages are currently unobserved. One of the only ways to probe this epoch is via the redshifted 21-cm signal from neutral hydrogen at frequencies below 50 MHz. An observation of this information-rich signal will help researchers understand the expansion of the universe, structure formation, the nature of dark matter and dark matter-baryon interactions. However the ionosphere and human-made radio signals prevent observations from Earth at these frequencies. CosmoCube is a UK-led mission to observe the 21-cm signal between 5 and 100 MHz (z ~ 13-285) from Lunar orbit. The proposed microsatellite is being developed as a candidate ESA mini-F mission, having recently received positive feedback on an expression of interest submission, and has previously been funded by UKSA under the bilateral program. Drawing on experience from the ground-based REACH experiment, CosmoCube brings together expertise in Bayesian inference, theoretical modelling, and instrumentation design from UK and international partners — including University of Cambridge, RAL, University of Portsmouth, SSTL, ASU, Embry Riddle, NASA JPL, and the University of Malta — to deliver a timely, cost-effective path to the first direct observations of the Dark Ages. In this talk, we will review the mission concept, recent progress on the thermal modelling of the instrument, spectrometer design and calibration pipeline as well as the roadmap to launch within the next few years.

The Solar Atmospheric Modelling Suite (SAMS): Current status

Authors

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Abstract

Accurate modelling of the solar atmosphere is essential for understanding the energy flow and build-up that underpins the heating of the solar chromosphere and corona, and drives eruptions and flares. Such a model would need to be able to capture the fundamental physical, radiative and ionisation states of the vastly different atmospheric layers of the Sun and the complex coupling between them. In this talk I will present our project where we are developing a software framework (the Solar Atmospheric Modelling Suite - SAMS) where we are building a modular code containing an exascale-ready, GPU-accelerated MHD engine coupled with a wide range of physics modules including 3D radiative transfer, updated atomic models and multi-fluid capabilities. After a year into this 5-year project key aspects of the MHD code engine along with implementation of multi-fluid physics and new atomic modelling have been completed. I will provide an update of where we are and the next steps we plan.

ROARS: Research Observatory for Atmospheric Responses to Sun-magnetosphere interactions

Authors

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Abstract

The Earth's upper atmosphere is highly sensitive to solar activity and the solar wind–magnetosphere interaction. Magnetospheric current systems close through the ionosphere, where ion-neutral collisions and enhanced energetic particle precipitation can significantly modulate the spatial and temporal variability of the atmosphere's outer extent. Unlike the many isolated in-situ measurements conducted by previous space missions, distributed observations of neutral particles, plasma, and magnetic fields by a tetrahedron of micro-satellites, combined with precise tracking of satellite orbital dynamics, provide the global perspective needed to disentangle the complex transfers of energy and momentum through the tightly coupled magnetosphere–ionosphere–thermosphere system.

In this presentation, we outline the ROARS F3 mission architecture. This mission seeks to obtain the first full curlometer magnetic field and energetic particle precipitation measurements in low Earth orbit (LEO), alongside concurrent measurements of the ambient plasma and neutral populations across a range of altitudes, latitudes, and longitudes. The measurement strategy is designed to resolve and characterise the energy and momentum entering the upper atmosphere, the multi-scale pathways through which these are redistributed, and the feedback mechanisms coupling back to the broader geospace environment. A comprehensive ground segment will simultaneously provide context by relating information on D- and E-region dynamics to the in-situ measurements.

Tools for the Future: Solar Physics Missions beyond Solar Orbiter

Authors

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Abstract

The international solar physics community currently enjoys access to a broad range of world-leading ground and space-based facilities in which the UK plays major hardware and science leadership roles (e.g. STEREO, Hinode, DKIST, Solar Orbiter (EUI, SPICE, SWA and MAG) and PUNCH). UK leadership through these existing missions and facilities has led to significant roles (science and instrumentation) for the UK in the next generation of solar missions currently in development: MUSE (Multi-slit Solar Explorer), SOLAR-C and EST (European Solar Telescope). In response to ESA's M8 call the UK leads the SPARK (Solar Particle Radiation and Kinetics) mission and is involved in DarkSun.
In this presentation we give an overview of the capabilities of upcoming missions and facilities and the UK's current role. We discuss how the UK might further leverage these roles for greater return, as well as to new instrument concepts where the UK is currently either leading developments or providing critical science expertise.

SIRIUS - Stellar and ISM Research via In-orbit Ultraviolet Spectroscopy (Invited)

Authors

Martin Barstow (1), On behalf of the SIRIUS project team

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Abstract

SIRIUS is a small space science mission designed to study the environment surrounding our Sun and nearby stars in the Galaxy, out to distance of 100-200 parsecs. The scientific programme will be executed by a high-resolution (resolving power of 5000) extreme ultraviolet spectrograph covering the wavelength range 170-260Å. The mission has been proposed to several small-mission calls. For the ESA F2 call it was selected as the back-up mission, which led to UKSA funding a phase 0 study. The aims of the study were to evaluate options for reducing the cost of the mission by utilising off-the-shelf space craft and shared-launch solutions. The instrument team and the mission science are led by the University of Leicester with contributions from other UK groups. The payload will be provided by an international consortium with partners from Germany, Spain and Belgium. The wider project consortium includes industry partner BAE/In-Space Missions (spacecraft and operations) and Oxford Space Systems (telescope deployment). SIRIUS is piloting a new approach to space science, delivering high quality, observatory class science at significantly lower cost than by "traditional" programmes. The mission was proposed to the recent ESA mini-F missions call, but was moved into the F3 competition. This paper will describe the SIRIUS instrument and its scientific capabilities and report generally on the status of the ESA F3 mission call.

The Lunar Surface Electromagnetics Experiment: LuSEE-Night

Authors

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Abstract

The NASA/DOE LuSEE-Night experiment (Bale et al. (2023), arXiv:2301.10345) will be deployed on the lunar farside in early 2027 to make full-Stokes spectral measurements of the radio sky below 50 MHz using a simple crossed-dipole antenna system. LuSEE-Night will be a pathfinder for future farside observatories, demonstrating many of the (quite ambitious) technologies required to make synoptic, radio quiet measurements throughout the lunar night. LuSEE-Night will use an orbiting far-field calibration source to characterize antenna gain and pattern and includes a simple rover-mounted radar experiment that will be used to sound the nearby regolith. Additionally, a second experiment LuSEE-Lite will make direct measurements of the DC electric field on the lunar surface which is thought to be a controlling factor for the electrostatic dust levitation which gave rise to the lunar 'horizon glow' observed by the Apollo astronauts.

I will describe the overall system and instrument design, including some of the technological challenges, and the program status, and opportunities for collaboration.

The CASTOR Mission: Unveiling the ultraviolet Universe

Authors

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Abstract

The Canadian-led Cosmological Advanced Survey Telescope for Optical and ultraviolet Research (CASTOR) is a wide-field, nearly diffraction-limited space telescope currently under development. The 1-metre telescope will deliver panoramic ultraviolet and optical imaging across 150-500 nm, achieving Hubble-like image quality over a 0.25 square degree field of view. Simultaneous three-band imaging will be possible using dedicated CMOS detectors, with additional planned instrumentation including a low-resolution grism for slitless spectroscopy and a parallel UV multi-object spectrograph. CASTOR will provide a powerful new facility for ultraviolet astronomy in the 2030s.

In parallel development is the Finding Optical Requirements and Exposure times for CASTOR (FORECASTOR) tool, designing a suite of planning tools for observation preparation, data reduction, and scientific analysis for the CASTOR mission. These tools will allow users to design observations and evaluate expected scientific performance ahead of launch. This talk will present the current status of the CASTOR mission and the FORECASTOR tool. We will also present preliminary results using FORECASTOR to investigate the reproducibility and systematic uncertainties of photometrically derived star formation rates in the CASTOR era, in preparation for CASTOR's Phase A+ study.

The NewAthena X-ray Observatory

Authors

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(1) University of Edinburgh
(2) University of Leicester

Abstract

NewAthena will be the European Space Agency's next large X-ray observatory. It will have revolutionary capabilities enabled by the combination of a large collecting-area mirror, a high-resolution spatially resolved X-ray integral-field spectrometer, and a wide-field X-ray imager. This next-generation observatory will thus enable transformational progress across all areas of astrophysics. NewAthena is the second L-class mission in ESA's Cosmic Vision programme, expected to undergo formal adoption by ESA in 2027 and then enter the implementation phase, with launch planned for 2038.

This talk will provide an update on the status of the NewAthena study phase, the roles of the UK in the mission, and the broad range of science that NewAthena will enable – including the growth of supermassive black holes across cosmic time and their impact on galaxy evolution, the assembly of the large-scale structure of the Universe, the stellar lifecycle (and its endpoints), the equation of dense matter in neutron stars, and the astrophysical nature of neutrino and gravitational wave sources.

FOSSIL: An ESA Medium class mission to transform our knowledge of the cosmic microwave background's spectrum. (Online)

Authors

Giorgio Savini on behalf of (1), The FOSSIL UK Collaboration (2)

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Abstract

Measurements of the cosmic microwave background (CMB) spectrum, from Penzias and Wilson to COBE/FIRAS, have played a transformative role in establishing our cosmological model.
Whilst knowledge of the CMB spatial anisotropies has dramatically advanced, in sensitivity, spatial resolution and polarisation, there have been no new measurements that improve the existing accuracy of the knowledge of the CMB spectrum in more than 30 years! The talk will describe the FOSSIL (FTS fOr CMB Spectral diStortIon expLoration) satellite, a mission concept submitted for the recent Medium-class 8 ESA call within the Voyage 2050 program. FOSSIL aims to improve our measurements of the CMB spectrum by more than three orders of magnitude. It will detect three previously unmeasured cosmological signals: the average distortion to the CMB caused by hot free electrons (mean Compton-y or thermal Sunyaev-Zel'dovich effect), the variation caused by relativistic electrons (relativistic Sunyaev-Zel'dovich effect) and the signature of Silk damping in the early Universe (μ distortions. These guaranteed signals will inform us about the properties of cosmic structure formation, the nature of dark matter and the physics of the primordial Universe. Even more exciting is the huge range of beyond ΛCDM signals that may be detected by FOSSIL: these include signatures of novel primordial processes, primordial blackholes, dark matter decays and features of recombination.
FOSSIL will achieve this by using a dual-channel / dual-beam Fourier Transform Spectrometer (FTS) performing constant differences between wide beams in the sky and an internal precise thermal black-body reference kept at a temperature close to that of the CMB itself to maximise the dynamic range available to difference signals. The two ports of the spectrometer can be alternated each between calibrator and sky by two beam-switching mechanisms for calibration, systematic error checks as well as risk mitigation. In order to appreciate the small variations, we aim to detect, the detectors at the output will be cooled to sub-K temperatures and separated in two spectral bands. A lower band will focus on the primary science described above, including frequencies up to ~300 GHz and a higher frequency band spanning frequencies from the latter up to ~2 THz which will provide low-resolution all sky maps in ~130 frequency bands aiding in foreground removal for the primary science while breaking degeneracy between the Cosmic Infrared Background (CIB) and galactic dust emission.

Laboratory astrophysics - what future ?

Authors
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Abstract
Accurate atomic data are a cornerstone of astrophysical research - vital for interpreting the spectral analyses that drive our understanding of the Universe. The weakest link in modern astronomical spectral analyses is often poor quality atomic data or models. With the next generation of telescopes and surveys on the horizon, these demands are only set to increase. Improvements need both theoretical and laboratory work. Unfortunately, the number of researchers world-wide has been decreasing, and has reached a level that poses a grave threat to the future of the field - once lost, it will be impossible to meet the growing demands of modern astrophysics.
We give a short overview of the current state and needs of atomic data for astrophysics.

The ESA M7 candidate mission Plasma Observatory: Unveiling plasma energization and energy transport in the Magnetospheric System with multiscale observations

Authors

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Abstract

Plasma energization and transport of energy are key open problems in space plasma physics. Their understanding is a grand challenge of plasma physics that has implications for research fields spanning from space weather to the farthest astrophysical plasmas. The Earth's Magnetospheric System is a complex and highly dynamic plasma environment where strong energization and energy transport occurs, and it is the best natural laboratory to study these processes through in situ measurements. Theory, numerical simulations, and previous multi-point observations from missions such as ESA/Cluster and NASA/MMS have evidenced that cross-scale coupling has a fundamental role in plasma energization and energy transport. Therefore, in order to ultimately understand these key processes, simultaneous in situ measurements at both large, fluid and small, kinetic scales are required. Such measurements are currently not available. Here, we present the Plasma Observatory (PO) multi-scale mission concept tailored to study plasma energization and energy transport in Earth's Magnetospheric System through simultaneous measurements at both fluid and ion scales. These are the scales at which the largest amount of electromagnetic energy is converted into energized particles and energy is transported. PO has an HEO 7.2x17 RE orbit, covering all the key regions of the Magnetospheric System including the foreshock, the bow shock, the magnetosheath, the magnetopause, the transition region, and the magnetotail current sheet. PO baseline mission includes seven identical smallsat Sister SpaceCraft (SSC) in two nested tetrahedra formation. The tetrahedra separation scales cover all typical ion and fluid scales of interest in the Key Science Regions and vary between ~50 km and 5000 km. The SSC payload provides a complete characterization of electromagnetic fields and particles simultaneously at multiple locations with measurements tailored to ion and fluid scales. PO represents the next frontier in fundamental space plasma research after Cluster and MMS and will allow us to resolve, for the first time, scale coupling in Earth's Magnetospheric System, leading to transformative advances in the field. Plasma Observatory is one of the three ESA M7 candidates, which have been selected in November 2023 for a competitive Phase A with a mission selection planned in June 2026 and launch in 2037.

The SPace-based InterFerometer Feasibility (SPIFF) Project: Enabling Future High-Resolution Astronomy Across the EM Spectrum

Authors

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Abstract

A growing number of astronomical science cases across the electromagnetic spectrum require high angular resolution observations beyond the current capabilities of our modern space-based observatories. Aperture synthesis via space-based interferometry (a technique already adopted by ground-based observatories like SKA, ALMA and VLTI) is the most plausible and scalable solution for achieving high angular resolution observations from space. From imaging ExoEarths and black holes to resolving the evolution of stellar systems through to galaxies, transformational science can be directly enabled by space-based interferometry. Despite decades of study at the concept level, low technological readiness at the system level has meant that no direct-detection space-based interferometer has ever launched. However, the UK possesses a unique trifecta of capability to break this deadlock: expertise in space-based instrumentation and ground-based interferometry; commercial capability in mission critical technologies with flight heritage; and world-leading astronomers whose science cases would directly benefit from, or be impossible without, space-based interferometry. Here, we present the SPace-based InterFerometry Feasibility (SPIFF) Project to lay the foundation toward a future technology demonstration mission, establishing the UK as the partner of choice for a future space-based interferometer L-Class/Great Observatory scale mission, while building domestic expertise and training the next generation of researchers in this transformational remote sensing capability. Beyond delivering groundbreaking science capable of re-writing textbooks, space-based interferometry is a disruptive technology with direct applications to other UK space priorities, such as Space Domain Awareness (SDA), In-orbit Service and Manufacturing (ISAM), and Position Navigation and Timing (PNT). The SPIFF Project was proposed to the UKSA Space Frontiers 2035 review, presenting the UK astronomical community an opportunity to play a lead role in the next major space observatory. We invite the community to engage with SPIFF and help us to advance the readiness of space based interferometry.

Lunar Farside Technosignature and Transients Telescope (LFT3)

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Note: Steve Raj Prabu (1) will present on behalf of David DeBoer.

Abstract
The Lunar Farside Technosignature and Transients Telescope (LFT3; https://lft3.space) is a proposed radio-telescope to land on the lunar farside by 2030. The mission is to be privately funded. The telescope covers 1 - 3000 MHz and comprises dipoles for HF (1-50 MHz) and VHF (60-250 MHz), and a 48-element phased array for UHF (300-3000 MHz). The systems will all fit on a 3-meter lander. The goal is to conduct unique-in-human-history surveys from the radio-frequency pristine environment of the lunar farside in advance of the many lunar orbiters that are being planned to support future missions and expeditions.