Goals of the LGWA science white paper

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Example 1: LIGO science white paper

https://dcc.ligo.org/LIGO-T2200382

- Executive summary, burst, CBC, CW, stochastic, joint activities
- No figures, no extensive text describing the science
- Structured into tasks
- Prioritization
- Table of FTE commitments

Example 1: LIGO science white paper

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Example 1: LIGO science white paper

	LSC-Virgo-KAGRA Observational Science Working Group			
	Burst	CBC (compact binaries)	Continuous Wave	Stochastic Background
Highest priority	Search for short-duration GW bursts (both online and offline)	Responding to exceptional compact binary coalescence detections	Targeted searches for high-interest known pulsars, e.g. Crab, Vela	Searches for an isotropic stochastic GW background
	Search for long-duration GW bursts	Cataloging detections of coalescence of neutron star and black hole binaries and their meaured parameters	Narrow-band searches for high-interest known pulsars	Directional searches for anisotropic stochastic GW backgrounds from point sources
	Responding to exceptional GW burst and multi-messenger detections	Characterizing the astrophysical distribution of compact binaries	Directed searches for high-interest point sources, e.g. Cassiopeia A, Scorpius X-1	Detector characterization, data quality, and correlated noise studies specific to SGWB searches
	Searches without templates from GWs from binary black holes	Testing General Relativity with compact binaries	All-sky searches for unknown sources, either isolated or in binary systems	All-sky search for extended sources using spherical harmonic analysis
	GW burst signal characterization	Low-latency searches to enable multimessenger astronomy	Long-transient searches for emission from nearby post-merger neutron stars	SGWB implications and modeling
		Multimessenger search for CBC-GRB coincidences	Follow-up searches of any promising candidates found by other searches	Development of python SGWB search pipeline
		Measuring the properties of extreme matter, e.g. the neutron star equation of state	Detector characterization, data preparation, scientific software maintenance	
		Determination of the Hubble constant		
...ority	Multimessenger searches for GW bursts associated with	Improved searches for intermediate mass black hole	Targeted searches for other known pulsars and non-	Data folding for efficient SGWB searches

Example 1: LIGO science white paper

1.2.1 Scientific Operations and O4 Observational Results

The Scientific Operations and O4 Observational Results priorities of the CBC group are:

1. **Highest priority**

   - **Responding to exceptional events.**
     We must be prepared to detect and respond to novel sources of extraordinary scientific importance. We define these as sources that yield significant new astrophysics and would warrant a rapid stand-alone publication. These would naturally include new detections of binary neutron stars, intermediate-mass or sub-solar mass binary systems. We also anticipate examples in which measurement of a source's parameters (e.g., masses and spins) could provide significant constraints on its formation channel or our understanding of stellar evolution (e.g., the possible existence of gaps in the black hole mass distribution, minimum or maximum neutron star mass). Other examples could include sources which are exceptionally loud and allow us to measure the source physics with unprecedented precision, thereby providing exceptional constraints on general relativity, or, for binaries containing a neutron star, improved measurement of the nuclear equation of state. Binaries with observed electromagnetic counterparts can significantly improve our estimate of Hubble constant using the standard-siren distance estimate.

Example 1: LIGO science white paper

LT-2.2 Search for long-duration GW bursts R&D (Long Term)

ACTIVITY LT-2.2-A: PIPELINE IMPROVEMENTS

TASK LT-2.2-A(i): cWB PIPELINE IMPROVEMENTS FOR LONG-DURATION BURST SEARCHES
Investigate options to improve the cWB sensitivity to long-duration burst signals.

TASK LT-2.2-A(ii): PYSTAMPAS PIPELINE IMPROVEMENTS FOR LONG-DURATION BURST SEARCHES
Investigate options to improve the pySTAMPAS sensitivity to long-duration burst signals.

TASK LT-2.2-A(iii): PYXEL PIPELINE IMPROVEMENTS FOR LONG-DURATION BURST SEARCHES
Investigate options to improve the pyXel sensitivity to long-duration burst signals.

TASK LT-2.2-A(iv): COCOA PIPELINE IMPROVEMENTS FOR LONG-DURATION BURST SEARCHES
Investigate options to improve the CoCoA sensitivity to long-duration burst signals.

ACTIVITY LT-2.2-B: PARAMETER ESTIMATION

TASK LT-2.2-B(i): SOURCE RECONSTRUCTION FOR ALL-SKY LONG-DURATION BURST EVENTS
Investigate modeled and unmodeled source reconstruction methods for long transients. It includes to adapt and test the Bayesian parameter estimation code for long-duration signals with

Example 2: ESA SciSpacE white papers

https://www.esa.int/Science_Exploration/Human_and_Robotic_Exploration/Research/The_SciSpacE_White_Papers

- Foreword + key planetary science topics
- Prose form to describe science topics including figures
- Prioritization

Example 2: ESA SciSpacE white papers

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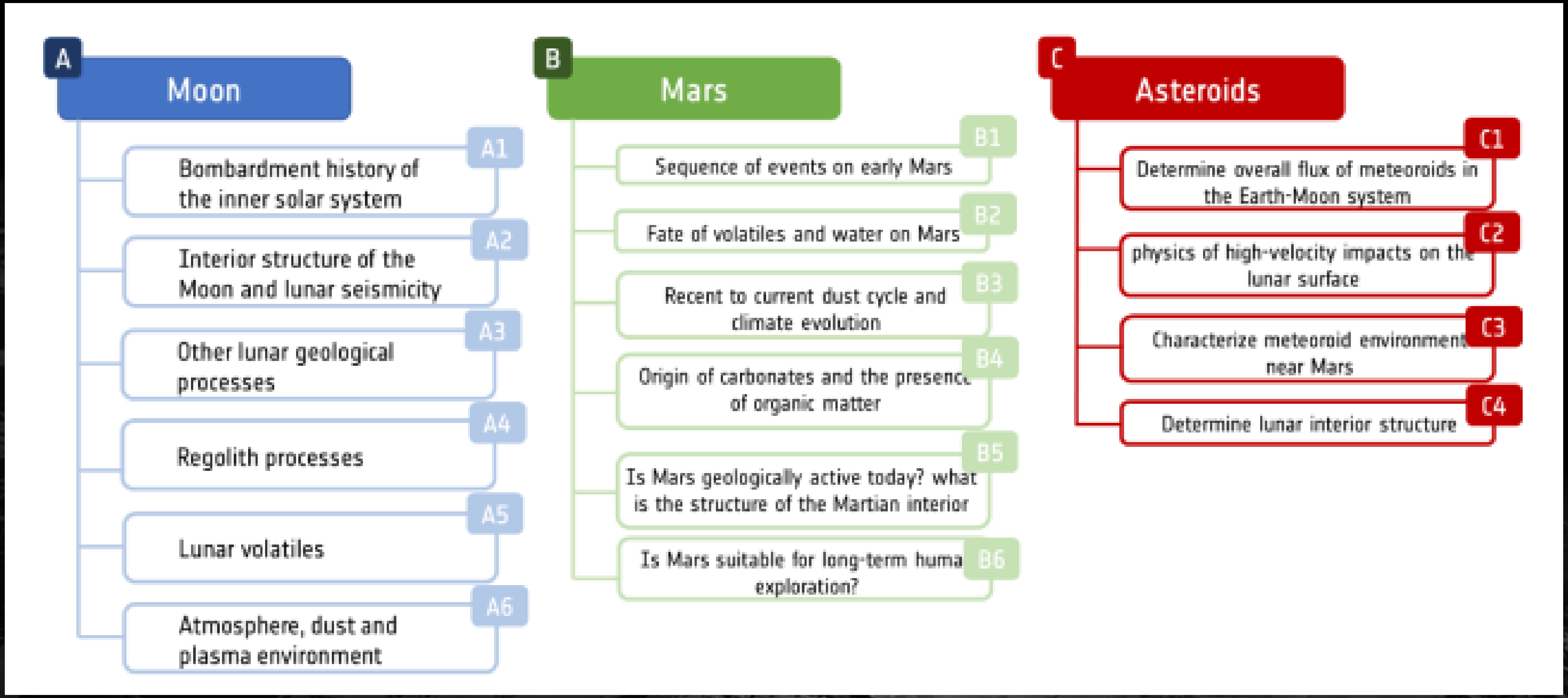
Planetary science



Example 2: ESA SciSpacE white papers

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2.1.2.3 Other lunar geological processes

Other geological processes prioritized for investigation are: (1) the formation and evolution of the crust, (2) volcanism, and (3) the impact cratering process.

The rich remote sensing data collected over the last decades has improved the understanding of lunar crustal rock compositions and mineralogy, and their global distribution across the Moon (e.g., Figure 2). With these data as a basis for selection of targets, for higher resolution and/or additional wavelength-range remote observations, and landing sites, for in situ analyses and sample collection/return, we can gain more information about key planetary processes that are revealed in the lunar crustal rocks. Goals outlined in earlier reports include: (1) investigating the compositions and distributions of the feldspathic crust, KREEP terrane (n.b. KREEP is is geochemical component), lower crustal materials, and the bulk Moon; (2) identification of new lunar rock types and their ages, distributions, and origins; (3) determining the local and regional complexity of the crust; and (4) exploring the vertical extent and structure of the megaregolith. Investigations of lunar crustal rocks can be driven forward by more advanced remote sensing measurements, in situ and returned sample analyses, and also by the installation of seismic stations and networks.

Volcanism is a major geological process on the Moon, which has significantly shaped the current lunar surface, and also provides information about its compositional and thermal evolution. Important questions regarding lunar volcanism include the determination of: (1) the origin and variability of lunar basalts; (2) the ages of the youngest and oldest basalts (which is also relevant for calibrating the lunar

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Example 2: ESA SciSpacE white papers

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2.1.4 Priorities for the HRE SciSpacE Programme

Key steps for future long-term exploration will require the development of enabling technologies such as:

- Precision landing and automated hazard avoidance
- Surface mobility
- Power and heating systems to enable survival during lunar night and within PSRs
- Tele-robotics
- Significant (>1000 kg) landed payload masses (e.g. EL3)
- Deep (10-100m) drilling capability
- Sample return
- Capability for extraction and caching of cold/icy samples (Cryogenic) sampling and caching
- Human operational capabilities in the lunar vicinity and/or on the lunar surface
- In-Situ Resource Utilization (ISRU)

Example 2: ESA SciSpacE white papers

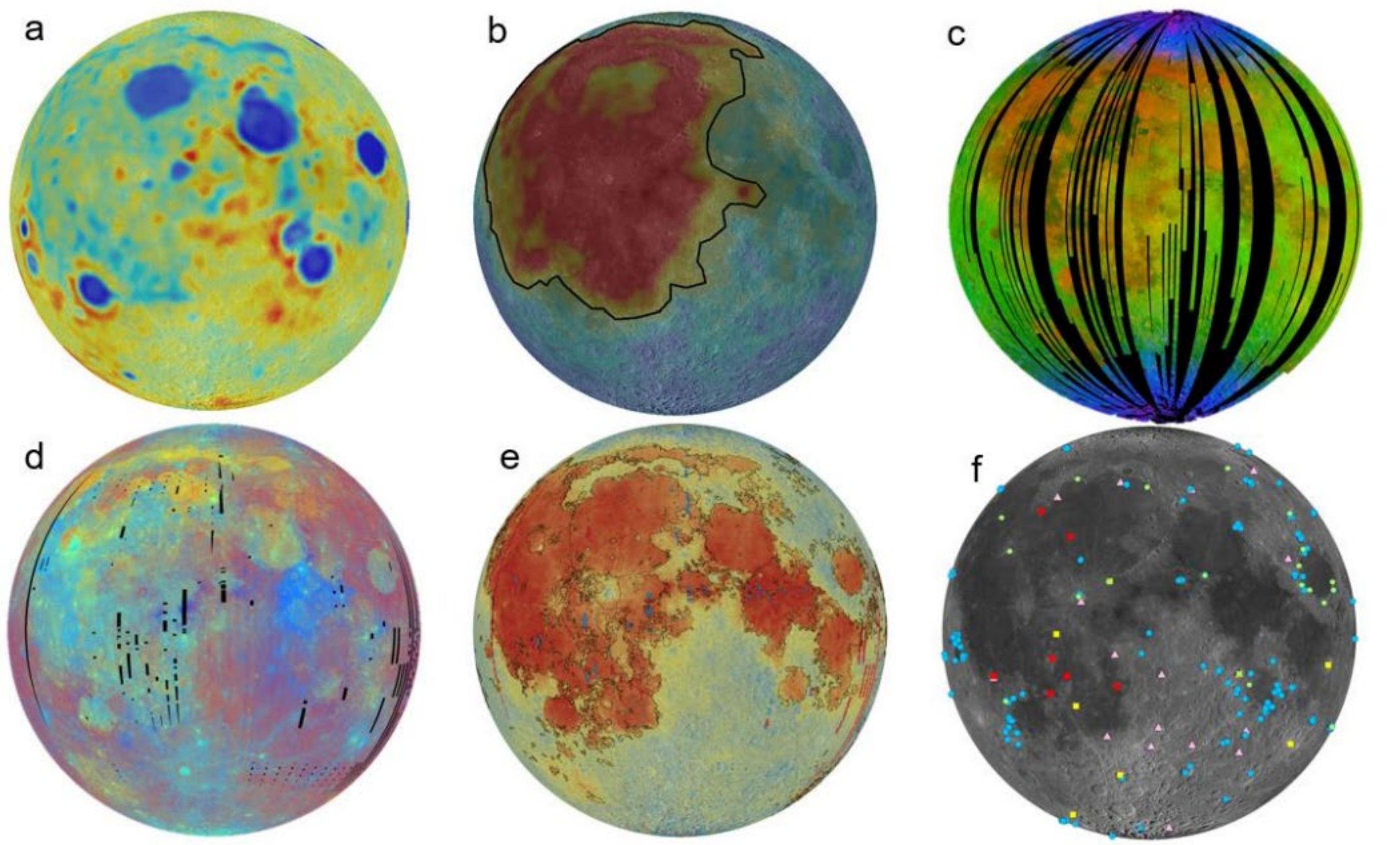

Figure 2: *Modern views of the lunar nearside (orthographic projection centered at longitude 0°).* ***a)*** *New crustal thickness models determined by the GRAIL mission (rainbow scale blue to red, 3-70 km) overlaid on the Lunar Reconnaissance Orbiter (LRO) Wide-Angle Camera (WAC) mosaic;* ***b)*** *Lunar Prospector Gamma Ray Spectrometer Th abundance (rainbow scale blue to red, 0.4-12.9 ppm) on the LRO WAC mosaic, where the black line outlines the limits of the Th-rich Procellarum KREEP terrane;* ***c)***

Example 2: ESA SciSpacE white papers

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2.1.6 Recommendations in short, middle and long term

Short term:

- Support European analyses of Chang’e-5 and Chang’e-6 lunar samples
- Continue geological training of ESA astronauts and development of their geological tools and tele-robotic capabilities
- Support continued geological and mineralogical mapping of the Moon and identification/characterisation of landing sites

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- LGWA is new, and we need to briefly outline mission and measurement concept, motivate sensitivity targets, explain what its relation is to other GW detectors
- We need to provide basic simulation and analysis tools
- We need to identify priority tasks as well and refer to prioritization in other important white papers, decadal surveys, etc
- We should have a part that summarizes dHz science more broadly so that it applies to other dHz concepts as well

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- Lunar science
- GW science including multiband studies
- Multi-messenger observations
- Synergies with other lunar missions