



# Discovering the Sky at Longest wavelengths (DSL)

— A combined DAIA/SULFRO/LUWISA mission

Albert-Jan Boonstra<sup>1</sup>, Tao An<sup>2</sup>, et al.

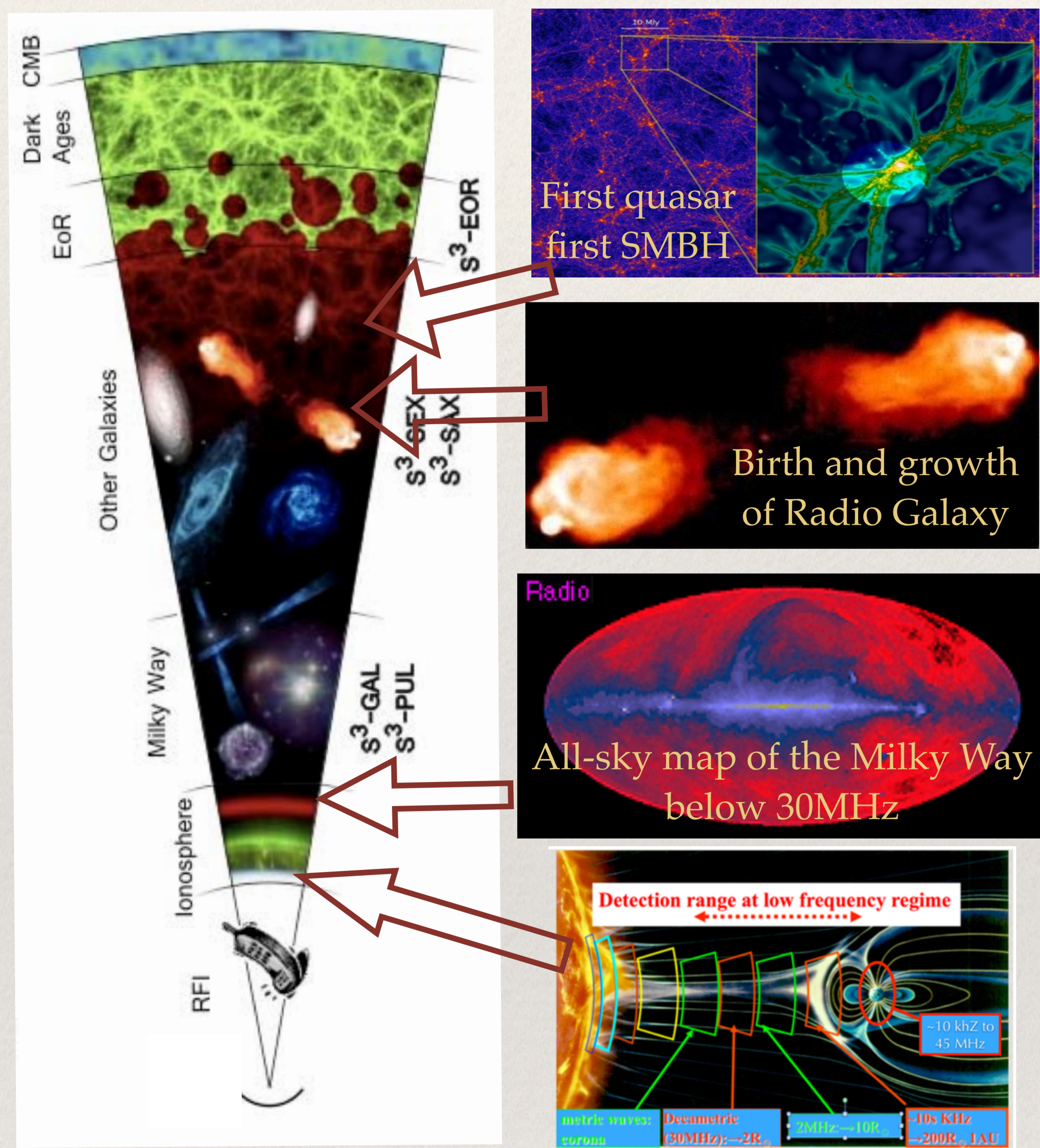
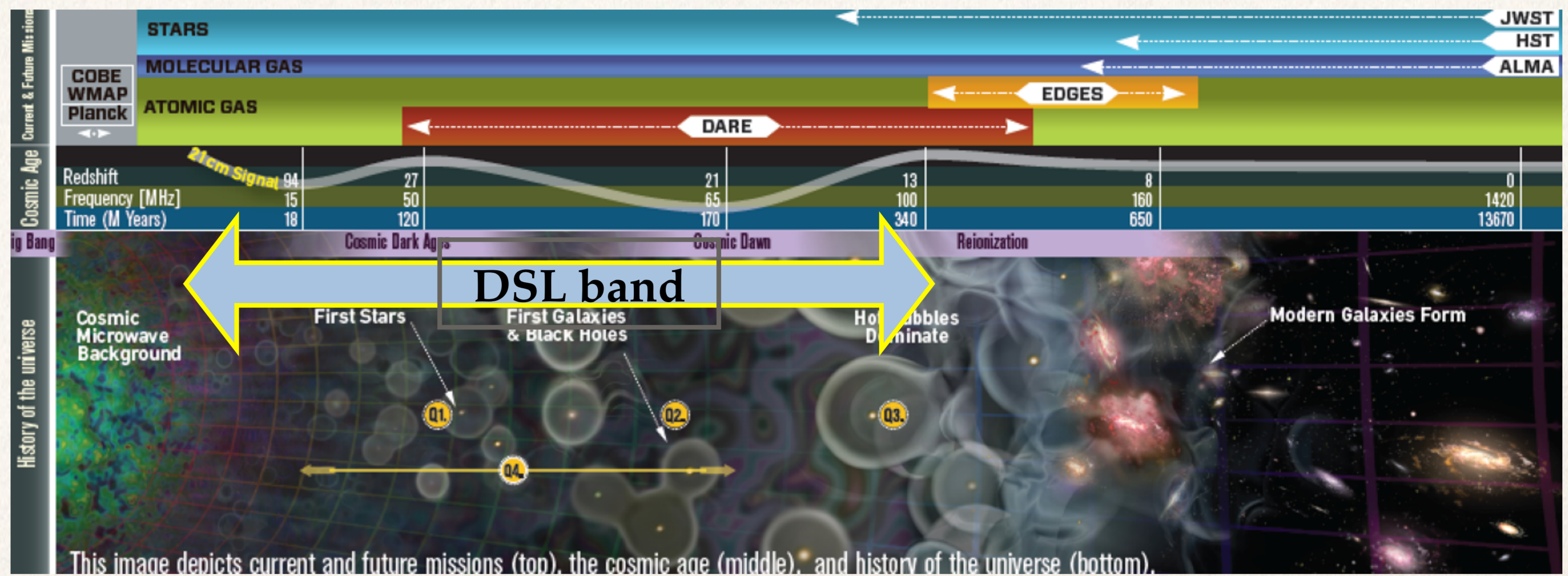
1. Netherlands Institute for Radio Astronomy, NL, ([boonstra@astron.nl](mailto:boonstra@astron.nl)) 2. Shanghai Astronomical Observatory, CN ([antao@shao.ac.cn](mailto:antao@shao.ac.cn))



**Abstract:** Scientific objectives for space-based ultimately-low frequency radio observatory are presented. The mission implement concepts and observing modes are briefly described. DSL will open up the last unexplored frequency range in the radio spectrum and will be a pathfinder of future high-resolution, high-sensitivity low-freq space radio observatory.

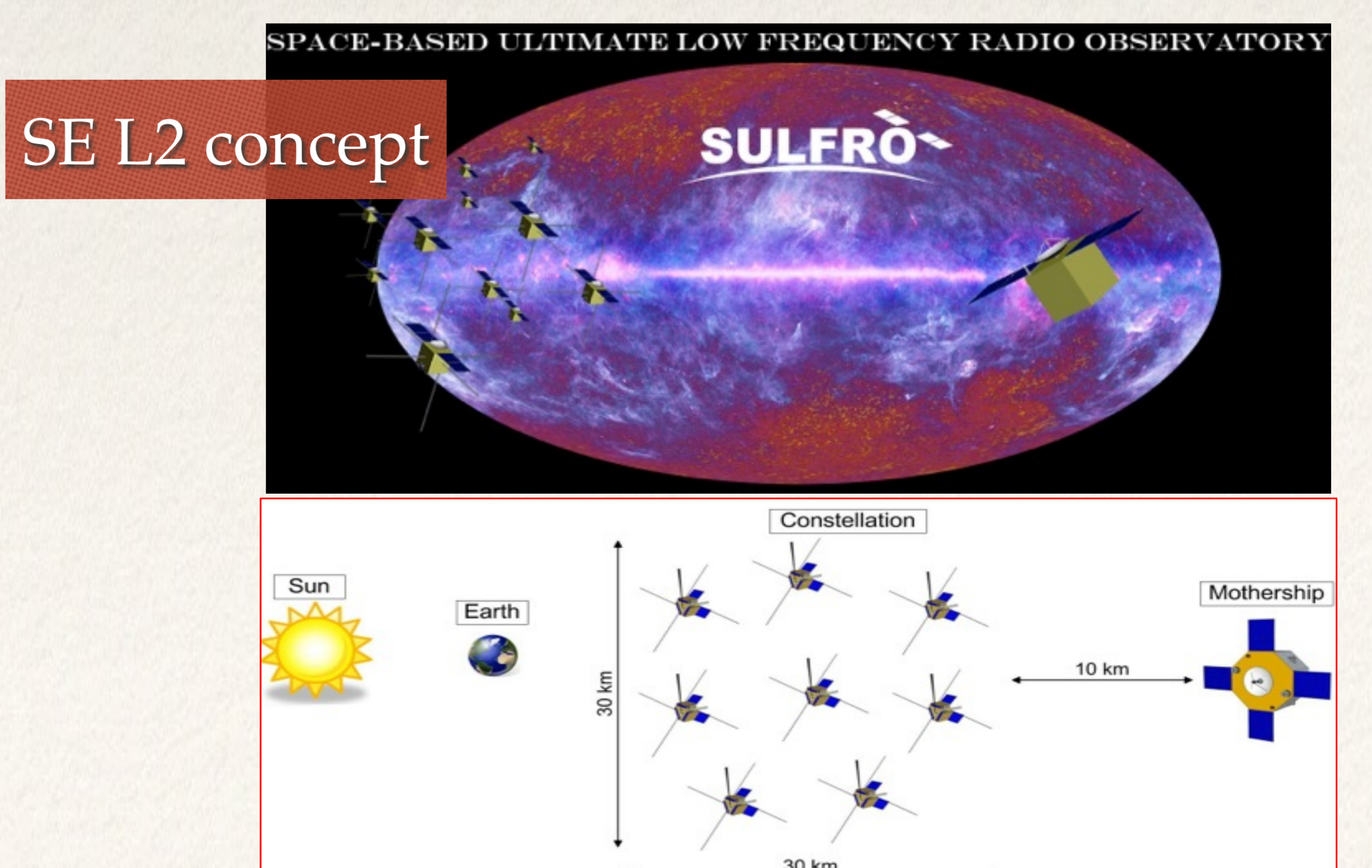
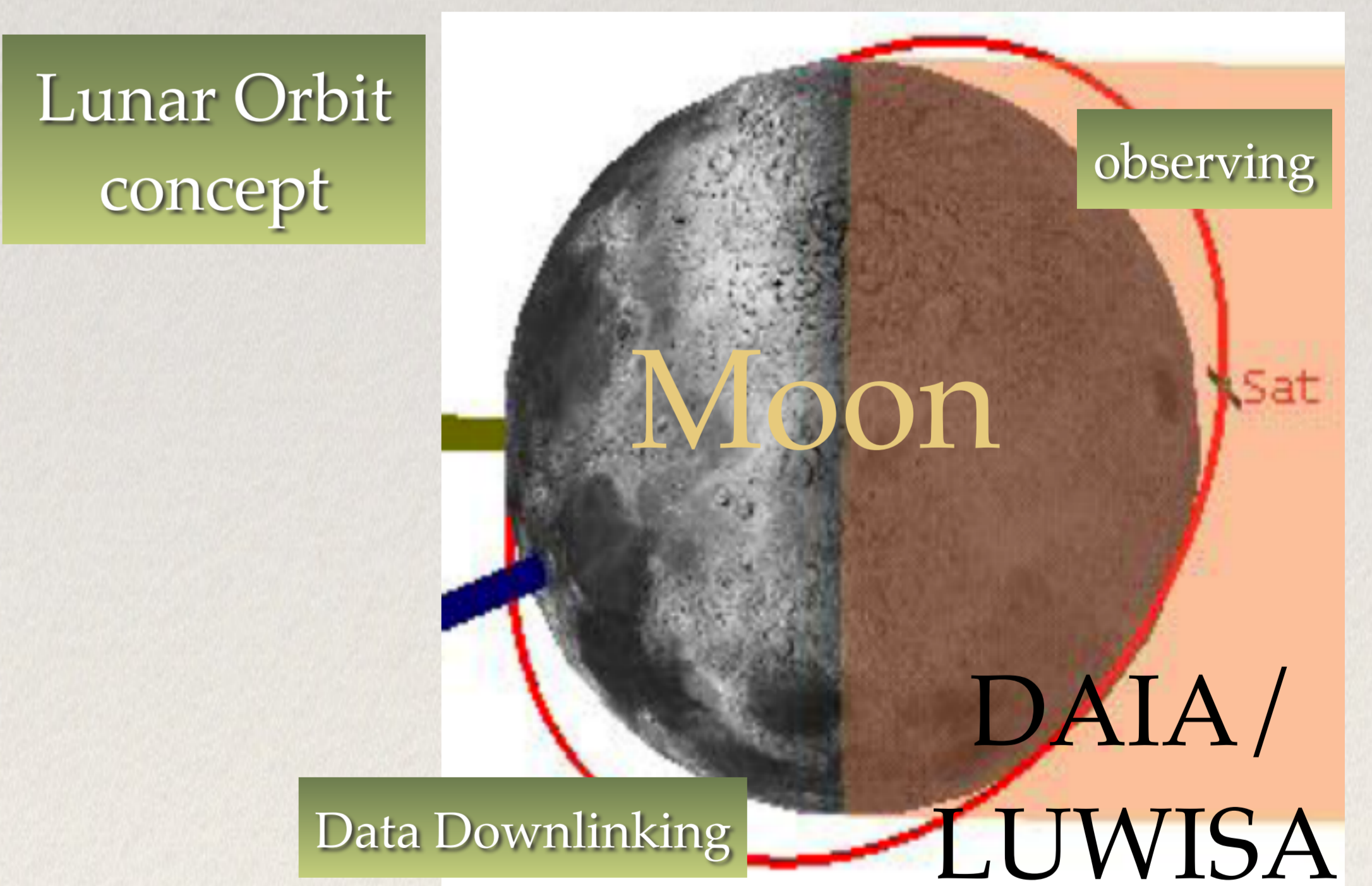
## Science Objectives:

- (1) to explore the whole history of the Dark Ages of the Universe using the 21cm signals of neutral hydrogen and to image the spatial structure of these emissions. The strength variation of these signals indicates the time when the first stars, the first galaxies, and the first black holes were formed;
- (2) to search for exoplanets, the hot Jupiter sources, and study their properties;



*More practical* science cases cover a broad level of celestial subjects occurring in 'the foreground' of the 21cm signals from the Dark Ages. These foreground signals can be imaged, identified and extracted from the data by the DSL.

- (3) An all sky survey will detect about 2 million discrete extragalactic radio sources and allow studies of the cosmological evolution of radio galaxies and their periods of activity;
- (4) The structure and emissions of the Galactic interstellar medium and the spectrum of pulsars at the lowest radio frequencies are largely unexplored.
- (5) DSL complements terrestrial imaging telescopes in imaging solar activity and coronal mass ejections (space weather) to beyond the Earth's orbit.
- (6) DSL can monitor emissions from planets and planetary magnetospheres



## Mission implement concepts

- A constellation consisting of 12 or more nanosatellites (observing telescopes) + 1 micro-satellite Mothership (processing, control data downlink center) => Imaging aperture array in space surveys all the sky all the time
- Frequency Range: 1 - 30 MHz (minimum)
- Array configuration: linear array or 3D-distribution array
- Deployment location : Moon orbit or Sun Earth Lagrange 2
- Observing modes: all-sky survey, spectroscopy, burst monitoring
- Formation flying: active control or passive free flying
- Mission lifetime: 3years
- A sketch map of lunar orbit (Left-up), and SE L2 (Left-Bottom) concept