

# POEMMA-Balloon with radio: A balloon born Multi-Messenger Multi-Detector Observatory

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The Probe Of Extreme Multi-Messenger Astrophysics (POEMMA) is a proposed dual-satellite mission to observe Ultra-High-Energy Cosmic Rays (UHECRs) increase the statistics at the highest energies and Very-High-Energy Neutrinos (VHENs) following multi-messenger alerts of astrophysical transient events, such as gamma-ray bursts and gravitational wave events, throughout the universe.

POEMMA-Balloon with radio (PBR) is a small-scale version of the POEMMA design, adapted to be flown as a payload on one of NASA's suborbital Super Pressure Balloons (SPBs) circling over the Southern Ocean for up to 100 days after a launch from Wanaka, New Zealand.

The main science objectives of PBR are: (1) to observe UHECRs via the fluorescence technique from suborbital space; (2) to observe horizontal high-altitude air showers (HAHAs) with energies above the cosmic ray knee ( $E > 0.5$  PeV) using the optical and radio detection for the first time; and (3) to follow astrophysical event alerts in the search of VHENs.

The PBR instrument consists of a 1.1m aperture Schmidt telescope similar to the POEMMA design with two cameras in its focal surface: a Fluorescence Camera (FC) and a Cherenkov Camera (CC). In addition, PBR has a Radio Instrument (RI) optimized for the detection of EASs (covering the 50-550 Mhz range).

The FC observes UHECR-induced EASs in the ultraviolet (UV) using an array of 9216 pixels Multi-Anode Photo-Multiplier Tubes (MAPMTs) imaged every 1  $\mu$ s. The CC uses a 2048-pixel Silicon Photo-Multiplier (SiPM) imager to observe cosmic-ray-induced HAHAs and search for neutrino-induced upward-going EASs. The CC covers a spectral range of 320-900nm with an integration time of 10 ns.

This overview will provide a summary of the mission with its science goals, the instruments, and the current status of PBR.

## Role of Submitter

I am the presenter

## Collaboration

PBR

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