Tenth Latin American Conference on Space Geophysics
September 8-12, 2014 - Cusco, Peru
X COLAGE

# ESTABLISHMENT AND OPERATION OF E-CALLISTO STATION IN PERU FOR MONITORING SOLAR ACTIVITY

Rengifo G. J.[1], V. Loaiza Tacuri[1], Guevara Day W.[1], C. Monstein[2]
[1]Dirección de Astrofísica (DIAST), Comisión Nacional de Investigación y Desarrollo Aeroespacial (CONIDA).
[2]Institute of Astronomy, Wolfgang-Pauli-Strasse 27, Building HIT, Floor J, CH-8093 Zurich, Switzerland.

## ABSTRACT

Solar activity indirectly affect the conditions of Earth's climate and space weather in general. Here, we will present the development Project CALLISTO in Peru. CALLISTO (Compound Astronomical Low, cost Low, frequency Instrument for Spectroscopy and Transportable Observatory) is part of the e-CALLISTO network trough program of implementation IHY/UNBSSI e ISWI instruments, sponsored by SNF, SSAA, NASA, Institute of Astronomy ETH, Switzerland for monitoring all types of solar burst at a wide range of frequencies (45 MHz to 870 MHz). Peru is an important node in America continent. One of the advantages to start solar monitoring in Peru is our strategic location near equator line that makes possible to observing the Sun all the year and exist very few instruments to cover the region.

## E-CALLISTO NETWORK

CALLISTO (Compound Astronomical Low cost Low-frequency Instrument for Spectroscopy and Transportable Observatory) spectrometers around world form the e-Callisto network were developed by C. Monstein from Institute of Astronomy ETH, Switzerland, and installed in different parts of the world. The main applications are observation of solar radio bursts and rfi-monitoring for astronomical science, education and outreach.


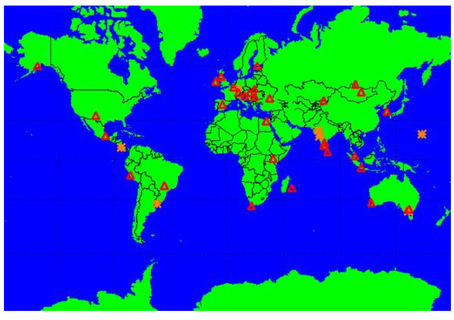

Fig.1 Map of current distribution of Callisto instruments in April 2014. Red triangles: locations provide data, orange star: locations do not provide data yet/anymore.

## COVERAGE OF SOLAR RADIO SPECTRUM CALLISTO IN PERÚ

The Coverage around the world of e-Callisto network to observe and monitoring the sun 24 hours in day and 365 day of year, in 2012 was not yet complete. But in Roswell, New Mexico in 2013 a new Callisto spectrometer was installed and this year, 2014 settled in Peru. These stations greatly increase the coverage America Pacific zone with Anchorage and Mexico. Now e-Callisto network have 100% coverage (See Fig. 3), assuming that all instruments working.

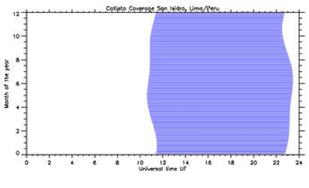


Fig 2. Coverage for solar radio observation in CONIDA-San Isidro, Lima, Perú. from the European-Asian region.

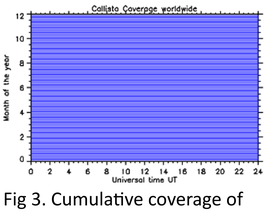


Fig 3. Cumulative coverage of all Callisto spectrometer locations, assuming all instruments are working and all antennas are tracking the sun.

## REFERENCE

[1] A. O. Benz, C. Monstein and H. Meyer, 2004. CALLISTO, A New Concept for Solar Radio Spectrometers, Kluwer Academic Publishers, The Netherlands.

[2] Pietro Zucca, Peter T. Gallagher, 2010, CALLISTO: Exploring metre-wavelength emission from the active Sun.

[3] Data e-Callisto: http://soleil.i4ds.ch/solarradio/callistoQuicklooks

[5] International Network of Solar Radio Spectrometers: http://www.e-callisto.org/

[6] V. Loaiza Tacuri, et all., 2014, Characterization of Logarithmic Periodic Antenna of the Station e-Callisto in San Isidro, Peru.

## E-CALLISTO IN PERU

The e-callisto station in Peru has a logarithmic periodic dipole array antenna (LPDA) with 23 elements in a fixed position covering 70-1000 MHz (See Fig 4.). The frontend comprises a low noise amplifier 33LN-ZX60-S from Mini-Circuits. The spectrometer called CALITO NA-07, was built in Anchorage, Alaska, USA by W. Reeve.

Fig. 4. LPDA Antenna at CONIDA (Comisión Nacional de Investigación y Desarrollo Aeroespacial), San Isidro. Lima, Peru (-12° 06'51'' S Latitude and 77° 03' 27'' W Longitude). Of left to right Walter Guevara, Verónica Loaiza, Javier Rengifo and Martín Vuelta.

Fig. 5. Yagui Antenna at Punta Lobos, Scientific base of CONIDA (-12° 30' 18'' S Latitude and 76°47'56'' W Longitude). Site where we will install other station Callisto.

In San Isidro and Punta Lobos (See Fig. 4 and 5) interference measurements were performed, and characterization of the LPDA antenna. The results of these measures are detailed in other work [6]. Callisto spectrometer data are stored in a computer, which by the FTP software Watchdog is shared with the network-and Callisto. The data that are shared are dynamic spectra, which show a signature if there is a variation in the intensity. Such intensity variation could be a solar burst (see fig. 7). Also Callisto software also shows a light curve (see fig. 6), Which represents the passage of the sun at noon, when the antenna is fixed vertically.

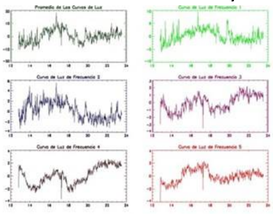

Fig 6. Light curves (Time vs. Relative Intensity) in differents frequencies

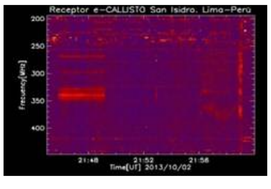


Fig. 7. Dynamic Spectrum with probable solar burst , October 02, 2013, in bandwith 190 a 450 MHz.

## CONCLUTIONS AND FUTURE WORK

With Callisto station installed in Peru, observer coverage worldwide has been completed in Pacific zone. The data used in the Space Weather continuous research and analysis of solar flares, in order to build a model of the solar atmosphere in the decimeter band. Currently the station Peru Callisto, works in San Isidro. We will install another Callisto station in a site with less RFI, in the coming months, in order to have a measure of redundancy and prevent data loss.

## ACKNOWLEDGMENTS

We would like to thank Luis Otiniano, Jorge Samanes and all staff at CONIDA for their support and help during the Callisto instalment.

CONIDA Agencia Espacial del Perú
Calle Luis Felipe Villarán 1069, San Isidro, Lima - Perú
E-mail: astrofisica@conida.gob.pe
Teléfono: (511) 441-9081 anexo: 146
DIAST Dirección de Astrofísica