C1XS - THE CHANDRAYAAN-1 X-RAY SPECTROMETER. Manuel Grande[1], Brian J. Maddison[2], P. Sreekumar[3], Juhani Huovelin[4], Barry J. Kellett[2] Chris J.Howe[2], Ian. A. Crawford[5], D.R. Smith[6] and the C1XS Team[7], [1]Institute of Mathematical and Physical Sciences, University of Wales, Aberystwyth, SY23 3BZ, UK, M.Grande@aber.ac.uk, [2]Rutherford Appleton Laboratory, Chilton, UK, [3]Space Astronomy & Instrumentation Division, ISRO Satellite Centre, Bangalore, India, [4]The Observatory, Univ. of Helsinki, Finland, [5]School of Earth Sciences, Birkbeck College London, London, UK, [6]Brunel University, Uxbridge, UK, [7] See below

The Chandrayaan-1 X-ray Spectrometer (C1XS) is a compact X-ray spectrometer for the Chandrayaan-1 lunar mission. It exploits heritage from the D-C1XS instrument on ESA's SMART-1 mission. By comparison with SMART-1, Chandrayaan-1 is intended as a science rather than a technology mission, leading to far more favourable conditions for science measurements. C1XS is designed to measure absolute and relative abundances of major rock-forming elements (principally Mg, Al, Si, Ti, Ca and Fe).

The baseline design consists of 24 nadir pointing Swept Charge Device (SCD) detectors, which provide high detection efficiency in the 1 to 7 keV range, which contains the X-ray fluorescence lines of interest. Micro-machined collimators provide a 14 degree FWHM FOV, equivalent to 25 km from 100km altitude. A deployable door protects the instrument during launch and cruise, and also provides a Fe55 calibration X-ray sources for each SCD. Refinements to the electronics, onboard software and thermal design greatly increase detector stability and signal to noise ratio compared to D-C1XS. This will result in a significantly improved energy resolution which should be better than 200eV throughout the lifetime of the mission (Fig 2). In order to record the incident solar X-ray flux at the Moon, essential to derive absolute lunar elemental surface abundances, C1XS carries an X-ray Solar Monitor (XSM). In comparison to D-C1XS, C1XS and XSM has been far better calibrated.

C1XS will arrive at the Moon in the ascending phase of the solar cycle, and the high incident X-ray flux coupled to an orbit optimized for science, means that we will obtain composition data accurate to better than 10% of major elemental abundances over the entire surface. Hence C1XS will be well-placed to make significant contributions to lunar science. The ~25 km spatial resolution enables C1XS to address a number of smaller-scale geological issues which also refine our understanding of lunar geological evolution.

C1XS is built and operated by an international team led from the Rutherford Appleton Laboratory. The PI is Prof M. Grande at Aberystwyth University. A major science and design contribution comes from ISRO Satellite Centre, Bangalore, India, and the XSM comes from the University of Helsinki, Finland. The Science team is chaired by I. A. Crawford.

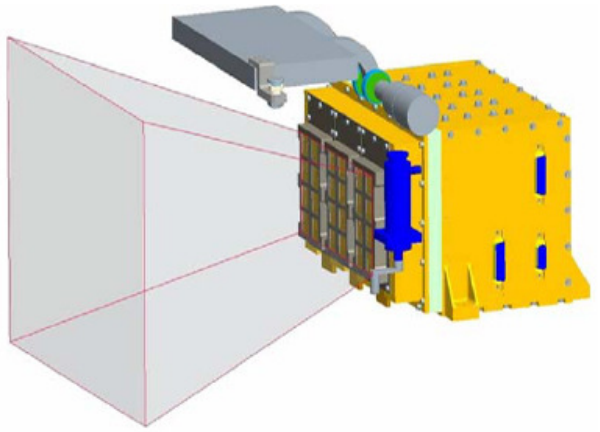

Fig 1: CAD image of C1XS showing coalligned front detectors, deployable radiation shield and 14^{O} FOV.

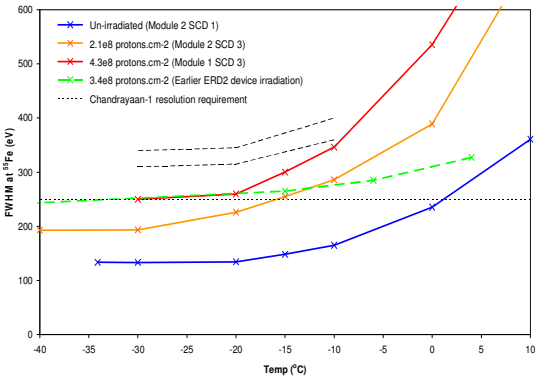

Fig 2: SCD FWHM at Mn-Kα vs. temperature, before and after irradiation. Maximum operating temperature is 17.5^{O} Note favourable comparison with D-C1XS performance shown in between the dashed lines

The C1XS Team: M Grande, A Cook, M. Wilding, (Aberystwyth Univ, UK), BJ Maddison, BJ Kellett, CJ Howe (Rutherford Appleton Lab, UK), P. Sreekumar, A Shrivastava, S Narendranath, (ISRO, India), J Huovelin (Helsinki Univ, Finland), I Crawford, K Joy (Birkbeck Coll. London, UK), C L Duston ,O Gasnaut, S Maurice, (OMP, Toulouse, France), DR Smith (Brunel Univ, UK), D Rothery, A Holland M Anand (Open Univ UK), S Russell, Natural History Museum, UK), JN Goswami, N.Bhandari (PRL India), D Lawrence, (Los Alamos National Lab, USA), V Fernandes, (U Berkley, USA), T. Okada, (ISAS, Japan), B Foing (ESTEC), C Pieters (Brown University, USA), M Wieczorek (IPG Paris, France)