National UK Science Workshop
Royal Astronomical Society

Date: 11th October 2013
Location: The Geological Society, Burlington House,LONDON, W1J 0BG
Organizing Committee: Neil Bowles(Oxford), Graziella Branduardi-Raymont (MSSL), Paul Eccleston(RAL), Enzo Pascale(Cardiff), Bruce Swinyard(RAL/UCL), Giovanna Tinetti (UCL), Gillian Wright (UKATC).

10:00	10:30	**Coffee**	
10:30	10:35	Introduction and welcome	
10:35	11:05	G. Tinetti (UCL)	The Science of EChO
11:05	11:25	P. Eccleston (RAL)	Preliminary design and performance of the EChO Payload Instrument
11:25	11:45	J. Barstow (University of Oxford)	EChO: the future for exoplanet atmosphere spectroscopy
11:45	12:05	J. Leconte	Terrestrial exoplanet atmospheres: what can we expect?
12:05	12:25	R. Nelson (QMUL)	Planet formation theory in the era of EChO
12:25	12:45	J. Tennyson	ExoMol: A new molecular line for hot methane
12:45	13:45	**Lunch Break**	
13:45	14:00	D. Queloz (University of Cambridge)	CHEOPS, on the ECHO path
14:00	14:15	P. Maxted (Keele University)	WASP targets for the EChO mission
14:15	14:30	D. Pinfield (University of Hertfordshire)	Fast-tracking the discovery of M dwarf transiting planets
14:30	15:00	Round table	
15:00	15:30	Poster session	
15:30	16:00	**Tea at the Geological Society**	

http://echo-spacemission.com/echoras2013/

Detailed List of Presentations

G. Tinetti (UCL)
Title – The science of EChO
Abstract - It is now accepted that exoplanets are ubiquitous in our Galaxy. The planetary parameters mass, radius and temperature alone do not explain the origin of the diversity revealed by current observations. The chemical composition of these planets is needed to trace back their formation history and evolution.
Pioneering results were obtained through transit spectroscopy with Hubble, Spitzer and groundbased facilities, enabling the detection of a few, most abundant ionic, atomic and molecular species and to constrain the planet's thermal structure. If launched in the next decade, EChO will address the following fundamental questions:

– Why are exoplanets as they are?
– What are the causes for the observed diversity?
– Can their formation history be traced back from their current composition and evolution?

Spectroscopic observations from the visible to Mid-IR of a large, select sample of exoplanets, will allow us to use the chemical composition as a powerful diagnostics of the history, formation mechanisms and evolution of gaseous and rocky exoplanets. Our strategy is to balance the statistical information, obtainable through a chemical survey of a large and diverse sample of objects, with deep, repeated observations of a more restricted, select sample of planets – a strategy that will enable the kind of science that has been accomplished for Solar System planets

P. Eccleston (RAL)
Title: Prelimiary Design and Performance of the EChO Payload Instrument
Abstract: The science of extra-solar planets is one of the most rapidly changing and exciting areas of astrophysics. Since 1995 the number of planets known has increased by almost two orders of magnitude. The Exoplanet Characterisation Observatory –EChO– will take us to a new phase where we begin to understand the physics and chemistry of these objects and, possibly, the detection of the signatures of life on other habitable planets. The ability to repeatedly observe exoplanets over a very extended wavelength range in a single run gives EChO a unique capability unmatched by any current or proposed mission.

The payload instrument is provides simultaneous coverage from the visible to the mid-infrared and must be highly stable and operate as a single instrument. In this presentation I shall describe the integrated payload design for EChO which will cover up to the 0.4 to 16 micron wavelength band. The instrumentation is subdivided into 4 channels (Visible, Short Wave InfraRed, Mid Wave InfraRed and Long Wave InfraRed) with a common set of optics spectrally dividing the field of view via dichroics. I shall discuss the significant design issues for the payload and the detailed technical trade-offs that have been undertaken to produce a payload for EChO that can be built within the mission and programme constraints and yet which will meet the exacting scientific performance required to undertake transit spectroscopy. This presentation will provide the overall view of the instrument architecture and design, along with initial simulations of the overall performance of the system using an end-to-end simulator of the mission.

J. Barstow (Oxford)
Title - EChO: The future for exoplanet atmosphere spectroscopy
Abstract - The field of exoplanet transit spectroscopy has advanced dramatically over the last decade. We are now pushing the boundaries of what current instruments are capable of; planets that have been observed with multiple facilities across the visible and infrared spectrum are still proving challenging to characterise (e.g. GJ 1214b; Barstow et al. 2013b). EChO represents the only imminent prospect of obtaining high quality spectral data simultaneously from the visible to the mid-infrared, yet this is a necessity if we are to make significant advances in our ability to constrain the properties of transiting exoplanet atmospheres. I will present results of feasibility studies for spectral retrieval of various exoplanet atmospheres with EChO, using the NEMESIS retrieval tool (Irwin et al. 2008) and based on the methods presented in Barstow et al. (2013a).

J. Leconte (LMD)
Title - Terrestrial exoplanet atmospheres: what can we expect?
Abstract - In theory, the nature of a planetary atmosphere depends on numerous, interacting processes which are difficult to model: accretion of volatiles, atmospheric escape, geochemistry, climate, photochemistry, etc... In front of so many coupled processes, our experience in the solar system, which contains only a few terrestrial atmospheres and which may well be atypical in the galaxy, is probably not sufficient to tell us about the diversity of possible atmospheres.

During the presentation, I will show that robust physical constraints exist which can help us speculate on what kind of atmospheres may or may not exist, depending on, among others, the size of a planet and the stellar flux it receives. I shall also discuss how EChO, by providing us with the chemical composition of the atmosphere of numerous exoplanets, can help us understand which processes control the formation and present structure of atmospheres in a wide variety of environments.

However, because of the three-dimensional nature of real planets and the accuracy sought by EChO, we know that modeling data with 1D atmosphere models will introduce biases in the retrieval of the thermal structure and chemical composition from the data. I will thus also present a 3D global climate model developed to model hot, cloudy terrestrial planet atmospheres and how it can help us correct these biases.

R. Nelson (QMUL)
Title - Planet formation theory in the era of EChO
Abstract - Radial velocity surveys show a strong correlation between the probability that a star hosts a giant exoplanet and the host star's heavy element content. This correlationis not observed for lower mass super-Earths and Neptune-like bodies, providing the first evidence that chemical compositionin the protoplanetary disc plays an important role in determining the types of planetary systems that can form. EChO will provide unprecedented measurements of chemical abundances in planetary atmospheres, and in this talk I will discuss approaches to modeling planet formation that will allow abundance measurements to constrain the formation and migration histories of planets in the EChO sample.

J. Tennyson (UCL)
Title - ExoMol: A new molecular line for hot methane
Abstract - Spectral characterization of astrophysical objects cool enough to form molecules in their atmospheres (cool stars, extrosolar planets and planetary discs) requires considerable amounts of fundamental molecular data. The existing line lists for many molecules, and particularly methane, are far from complete at the temperatures found in many exoplanets. The ExoMol project is actively generating comprehensive line lists for all molecules likely to be observable in exoplanet atmospheres in the foreseeable future, see Tennyson and Yurchenko (Mon. Not. R. Astron. Soc., 425, 21 (2012)) .

We have recently completed the calculation of a comprehensive list of transtions for CH4 encompassing all transitions likely to be important for temperatures up to 1500 K. This line list, which is known as 10to10, contains 9.8 billion rotation-vibration transtions. Some of the possible consequences of using the 10to10 linelist for exoplanet research will be discussed.

D. Queloz (University of Cambridge)
Title - CHEOPS, on the ECHO path
Abstract - CHEOPS has been selected by ESA as first S-class mission. The main science goal of the CHEOPS mission will be to study the structure of exoplanets smaller than Saturn orbiting bright stars. With an accurate knowledge of masses and radii for an unprecedented sample of planets, CHEOPS will set new constraints on the structure and hence on the formation and evolution of planets in the sub-Saturn mass range as well as pave the way for atmosphere characterizations with NGTS and Echo

P. Maxted Keele University
Title - WASP targets for the EChO mission
Abstract - By the time EChO is expected to be operational, the WASP survey will have discovered well over 100 bright transiting hot-Jupiters. I will summarise the properties of the extrasolar planets discovered by WASP and similar ground-based surveys and outline how these targets fit in to the EChO science programme.

D. Pinfield (University of Hertfordshire)
Title - Fast-tracking the discovery of M dwarf transiting planets

Abstract - I will describe ongoing efforts to fast-track the discovery of M dwarf planet transits. We have recently published the most complete list of bright (K<9) M dwarfs (potential EChO targets), and are following up these objects with low and high resolution spectroscopy. We plan to place constraints on the inclination of the rotation axis, and thus prioritise M dwarfs that are more likely to have transits. Targetted light curve follow-up with surveys/facilities like Apache and LCOGTN can then reveal transits within this comprehensive/prioritized sample.

Poster Session

	Author	Title
1	C. Danielski	Super Earths in the habitable zones. The EChO view
2	N. Bowles	A Prism Spectrograph for the EChO Long wave (11 -16 μm) channel.
3	R. Varley	Generation of a target list of observable exoplanets for EChO
4	J. Barstow	Solving the inverse problem for exoplanet atmospheres
5	E. Pascale	EChOSim: the end-to-end simulator of the EChO space mission
6	K. Barnes	Selex ES high performance infrared detectors for space and astronomy
7	E. Pascale	Detector testing for the EChO LWIR channel
8	M. Tessenyi	Molecular Detectability in Exoplanetary Emission Spectra
9	C. Sousa Silva	Modelling Molecules for Atmospheric Simulation : Phosphine
10	M. Gorman	Hot temperatures line lists for metal hydrides11
11	I. Waldmann	Decorrelating the planetary signals for EChO