

Report on Europlanet NA Workshop 'Uniting Planetary Modelling and Data Analysis (Part 2)' (July, 2019)

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Introduction

This workshop was co-organized by Nick Achilleos (UCL) and Nick Sergis (Observatory of Athens). It was a follow-up to complete the work and resources discussed during the initial workshop on this theme, organized by the same researchers which took place in September 2018. The theme for both events was to raise awareness of planetary modelling and data analysis techniques, and related resources, including some of the Europlanet research infrastructure. As well as conventional-format presentations by participants, both events also featured 'classroom'-style laboratories, introducing specific modelling applications and data analysis algorithms.

The URL containing further information, and presentations for this workshop, is at:

<https://www.ucl.ac.uk/planetary-sciences/news-events/europlanet-na1-workshop-uniting-planetary-modelling-and-data-analysis-part-2>

The URL above also contains links to the web page for the initial workshop.

An example of some of the materials provided to participants for one of the laboratory sessions can be downloaded as a zip archive from:

http://www.ucl.ac.uk/ucapnac/MDISC/mdisc_v2.zip

This archive contains a user guide, Matlab code and files related to planetary 'Magnetodisc' modelling exercises. The user guide also contains information about related Europlanet research infrastructure for further investigation by potential users of those services. An earlier version of these materials was used to deliver some training in model applications during the summer school 'COMAC 2018: MHD Simulations in Astrophysics and Space Plasma' which took place in Thailand in July 2018 (<http://chalawan.narit.or.th/home/index.php/event/comac2018/>), to which Prof. Nick Achilleos (UCL), Dr. Licia Ray (Lancaster University, workshop participant) and Dr. Patrick Guio (UCL, co-author of the archive, Europlanet developer) were invited.

Participants

We were pleased to be joined in Kalamata this year by Dr. Tom Krimigis, a very prominent space physicist and planetary scientist who has played a pivotal role in developing energetic particle detectors for space missions. Dr. Krimigis has had instrument PI roles on missions such as Cassini, the Saturn orbiter (2004-2017 orbital mission). He delivered our keynote presentation on observations and analysis related to the transition of the Voyager spacecraft beyond the boundaries of our Solar System / heliosphere. The details for all participants are

summarised below, with the information required by Europlanet Networking Activities:

Table 1: Workshop Participants (*Early career status here is defined as being from undergraduate, up to 5 years after receiving PhD)

Name		Gender	Affiliation/s	Career Stage*
Nick	Achilleos	M	University College London (UCL)	Senior Researcher
Penelope	Angelopoulos	F	National Observatory of Athens	Early Career
George	Balasis	M	National Observatory of Athens	Senior Researcher
Alex	Bader	M	University of Lancaster	Early Career
Will	Dunn	M	UCL	Early Career
Omiros	Giannakis	M	National Observatory of Athens	Senior Researcher
Tom	Krimigis	M	Academy of Athens (AA) / Johns Hopkins Applied Physics Lab.	Senior Researcher
Nantia	Moutsouroufi	F	National Observatory of Athens	Early Career
Carley	Martin	F	University of Lancaster	Early Career
Licia	Ray	F	University of Lancaster	Senior Researcher
Nick	Sergis	M	National Observatory of Athens	Senior Researcher
Stavros	Sklavenitis	M	National Observatory of Athens	Early Career
Tom	Stallard	M	University of Leicester	Senior Researcher

The table above gives an indication of participants' backgrounds and the gender balance for the event - in addition, Achilleos is a senior member of his home institute's LGBTQ+ employees' group, Out@UCL (<https://www.ucl.ac.uk/equality-diversity-inclusion/committees-and-social-networks/outucl>)



Figure 1: Participants: Back row, from left: Bader, Stallard, Ruffoni (family guest), Achilleos, Krimigis, Sklavenitis, Giannakis, Balasis; Front row, from left: Sergis, Ray (holding daughter Phoebe), Martin, Dunn, Angelopoulos, Moutsouroufi



Figure 2: Youngest member of the team.

Outcomes

- **Knowledge Exchange:** The presentations given by the participants covered modelling and data analysis related to the space environments of the planets Saturn, Jupiter and the Earth. The laboratory and ‘walk-through’ sessions provided preliminary training and descriptions of: applying model outputs to magnetic field and particle dynamics investigations; analysis of X-ray observations of planetary auroral emissions; preparation and processing of data for archiving purposes.

In a wider context, the participants also exchanged knowledge regarding the analysis and interpretation of X-ray, ultraviolet and infrared observations of planetary auroral emissions; the best algorithms and methods for characterising variability and typical conditions associated with auroral emissions, planetary ring currents and magnetospheric magnetic fields; the use of wavelet transforms and machine learning techniques for space weather studies and investigations of related variability of physical conditions in the Earth’s ionosphere; modelling algorithms and equation sets associated with magnetosphere-ionosphere coupling, morphology of magnetospheric boundaries, polar ionospheric outflows.

The discussions also frequently made use of, or referred to, datasets associated with space missions such as Cassini and Juno, and observational platforms such as the Hubble Space Telescope, the Chandra and XMM X-ray satellites. The final discussion session of the meeting also presented participants with an introduction to Europlanet services such as the Virtual European Solar Planetary Access (VESPA) databases, and the PSWS (Planetary Space Weather Services); as well as the auroral database APIS (Auroral Planetary Imaging and Spectroscopy).

- **Future Scientific Collaborations and Initiatives:** Breakout sessions during the workshop allowed par-

ticipants to continue with the laboratory training, and continue scientific discussions and interactions. An important breakout session identified a real need to answer the scientific question of the physical origin of the main auroral emission attacks Saturn. It was suggested that this could potentially form the basis of a future scientific meeting related to this subject, possibly to be organized, for example, as an event of the ISSI (International Space Science Institute).

- **Careers:** As well as providing the keynote address for the meeting, Dr. Krimigis took part in our ‘question and answer’ session, which was a valuable opportunity for researchers of different backgrounds to ask about the successes and challenges faced during his own career, and future prospects for young scientists seeking careers in space physics.
- **Educational Initiatives:** Some of the material presented by Prof. Achilleos was discussed as the possible basis for developing further pedagogical and educational material related to magnetospheric physics and particle dynamics. We will continue to develop this initiative further for all relevant material presented at the meeting, by seeking support for appropriate visiting lectureships. These will further foster scientific knowledge exchange through a platform involving education.