NanoSpace WG4 meeting Report

A small NanoSpace WG4 meeting to develop outreach activities was held at The Cardiff School of Technologies, Cardiff Metropolitan University, 21st - 24th January 2025.

In-Person Participants:
Simon Scarle (SS), Cardiff Metropolitan University (organiser), UK
Ian Smith (IS), Cardiff Metropolitan University, UK
Chris Ewels (CE), CNRS-IMN, France
Eleanor Campbell (EC), University of Edinburgh, UK
Ed Goldwyn (EG), Goldwyn Assoc. Ltd, UK
Ilija Rašović (IR), University of Birmingham, UK
Gaetan Clement (GC), Université Paris-Saclay, France
Alessandra Candian (AC), University of Amsterdam, Netherlands
Flavia Dell'Agli (FD), Astronomical Observatory of Rome, Italy
Zack Collins (ZC), Manifold Games, UK

On-Line Participants:
Irene Sciriha (IS), University of Malta, Malta
Job Oyebisi (JO), Queen Mary University of London, UK
Jan Cami (JC), University of Western Ontario, Canada
Joy Olayiwola, National Space Research and Development Agency, Nigeria
Deniz Ekinci, Ondokuz Mayıs University, Turkey



Fig. 1 Group Photo. Standing (left to right): Flavia, Ed, Simon, Chris, Eleanor, Ian. Front: Alessandra, Gaetan, Ilija.

Philosophy: The meeting aim was to bring together a truly diverse, interdisciplinary small group (max 12) to take and develop unusual outreach ideas and drive selected ones all the way to deliverables. This is necessary for projects such as NanoSpace where no one person (or

group) has all the required skills – the project draws on astrophysicists and astrochemists, low temperature physicists, nanoscientists and carbon scientists, as well as here, games designers and developers and video and TV producers.

Rough Meeting Structure:

0. Pre-preparation (zoom, shared google document, email).
1. Day 1 – introductions, primer talks, "setting the scene".
2. Day 2 – Discussion, brainstorming, idea development and prioritisation.
3. Day 3 – Deliverable's development.
4. Day 4 – Deliverable presentation and summary, "next steps" strategy.

Preparation: The meeting was developed over a four-month period including a zoom meeting between participants, extensive email, and polling. This allowed us to develop a google document with a wide range of outreach deliverable ideas, and to start developing ideas in advance. This was very successful and meant the meeting was able to start directly.
https://docs.google.com/document/d/1UTUcn8kpo3DB0HNfzZGChy-nWlO7dUZUI6lYrebMT24/edit?usp=sharing

***Day 1 - Tuesday 21st January**

Participants arrived by lunchtime on Tuesday. The afternoon served mainly to introduce the participants to each other and provide introductory presentations on different aspects of NanoSpace and game development to cater for the wide range of interdisciplinary expertise of the participants (astrochemistry, fullerenes, science communication and outreach, game development). Four scheduled introductory presentations were given:

Alessandra Candian	"Astrochemistry Primer"
Chris Ewels	"Fullerenes / nano carbon Primer"
Simon Scarle	"Serious Games Primer"
Ian Smith	"A brief introduction to ludology, game mechanics and the Game Design Document (GDD)"

Participants spoke about their outreach experiences and suggestions they had for activities to be developed.

It was decided to split the participants into three breakout groups to work on specific ideas and present a prioritised plan on Wednesday morning for the remaining days. These groups were:

Online: to think about a digital game; e.g. involving moving over the surface and manipulating the fullerene structure (IS, JO, ...).

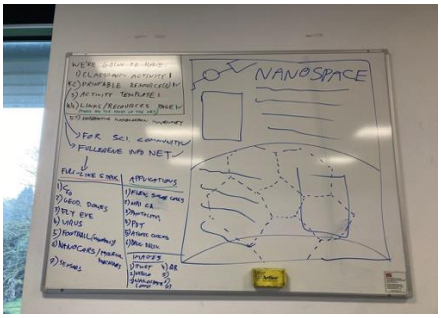
Educational resources: to come up with a prioritised list of paper and online educational resources to be worked on during the meeting (FD, AC, EC, IR).

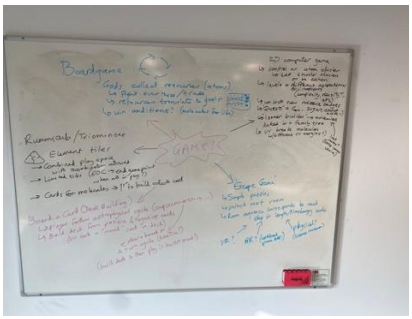
Games: to decide on digital and physical games that should/could be developed (CE, SS, IS, EG, GC, ZC).

Informal discussions continued at dinner (Brewhouse & Kitchens).

*** Day 2 - Wednesday 22nd January**

The participants divided into their respective groups and worked on tasks until late morning when the outcomes of the initial discussions were presented to the rest of the participants for feedback and further suggestions.





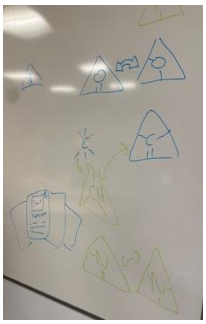


Fig. 2 White Board Summaries of Group Discussions.

JC joined via Zoom to provide astronomy expertise and provide feedback on the presented ideas.

The groups continued to work on their ideas for the rest of the afternoon.

Informal discussions and origami sessions continued over dinner at Mount Stuart.

***Day 3 - Thursday 23rd January**

Intense breakout group work throughout the day.

Educational Resources: NanoSpace brochure/poster completed, fullerene cut-out prototype prepared and collection of images/accompanying text almost completed (QR code and fullerene-related images printed on cut-out with links to online information about images). Template for collecting educational resources completed.

https://docs.google.com/document/d/1e0KrS7QRKr1Nz8m2ZcJkUve5JS5gp9rh2902QxTPv_0/edit?usp=sharing

Games: Simple physical version of "BuckyBert" digital game produced and tested. Discussions around concept for a "molecular growth game" both physical and digital. Idea of "Cheminoes" to construct molecules.

Both in-person groups came together in the late afternoon to discuss the game concepts and develop the idea for a "Life from Space" board game.

Conference dinner at Maison de Boeuf.


Fig. 3. Conference Dinner.

***Day 4 - Friday 24th January**

Summary and discussion of priorities for funding and taking forward. Selection of deliverables to finalise for presentation at NanoSpace Annual Meeting in Kaunas in May 2025.

Summary and responsible Leads/Contributors

Educational resources (FD main lead):

NanoSpace Brochure Finalised (IR). Can be used for A0 poster, roller banner, smaller scale (A5) printouts for distribution. CE/EC agree printing needs with Anibal. Have on display at May meeting.

Foldable cut-out C_{60}. Shared document to be completed with finalised illustrations and text (EC/FD/AC). The document should be shared with web manager to be incorporated in NanoSpace web pages. Printed A3 cut-outs to be made available at May meeting. Can be included in "Universe in a Box" resource for schools.

Future: Make 3D printed version with Braille for the visibly impaired? Multi-lingual webpage support?

Complete resource template with existing school activities (FD/CE/IR). Advertise resources template at May meeting and make completed school activity sheets available on website (FD). Initial activity sheets on (a) Ion-implantation school activity using balls (IR), (b) Chemistry bonding paper-based game (CE).

DIB ringtone to be developed by C. Campbell (University of Edinburgh) and made available for download on NanoSpace website with accompanying information text (EC).

Google Map with fullerene installations around the globe, advertise on social media (IR).
https://www.google.com/maps/d/u/2/edit?mid=1CXRVNr8AuUHbLtNJkKf__ZbJKVCtB4A&usp=sharing

Games (CE/SS Main Leads):

Cheminoes: develop as a physical resource for "Universe in a Box" (SS/CE). 3D printing prototypes to be prepared (SS) and costs for upscaled printing to be determined (SS/CE). Consider 3D printed option for the visually impaired. Origami templates to be prepared and made available for download (SS), inexpensive alternative to 3D printed option for schools

with limited resources. Explore Mixed Reality option using mobile phone to look at 3D molecular structure - how expensive would this be to develop? (SS/CE). Check whether anything similar already exists (CE). Have prototype game ready for testing at May meeting (CE).

BuckyBert: A colourful, digital game for two or more players who hop around the surface of C_{60} (and other nanocarbons) from hex-/pentagon to hex-/pentagon, colouring them in and forcing their opponents into confined spaces where they will be eliminated. GDD finalised (CE). Explore costs of developing into a final game (ZC, Manifold Games).

Eating Molecules Game - not taken any further at the moment but will be worked up to GDD (CE).

"Life from Space" Board Game. The basic idea has been worked out but detailed development and prototyping is still needed (All). This would be the most NanoSpace relevant activity. It would be desirable to organise an additional small meeting to develop the GDD and explore taking this further to a testable prototype.

It would be desirable to prepare a list of schools that could be used for testing the activities and providing feedback (FD?).

Funding Priorities for 2024

1. Printing costs (€1k)
2. Cheminoes: 3D printing of physical chemino prototypes (not expected to be expensive). 3D printing of sets for distribution in "Universe in a box" (TBD)
3. BuckyBert development into digital game (TBD)
4. "Life from Space" additional meeting

Associated Files:

Presentations, pdf deliverables, etc, are available here:
https://www.dropbox.com/scl/fo/7vt5pxpus9md9s2qxf295/AICBUNrQhZ3pbH2erEJM7v4?rlkey=gtdvmx9h6vyqhlold7tzem3pl&dl=0