



**AUSTRALIAN INSTITUTE OF PHYSICS  
TEACHERS' GUILD OF NEW SOUTH WALES  
THE ROYAL SOCIETY OF NEW SOUTH WALES  
ROYAL AUSTRALIAN CHEMICAL INSTITUTE**

*Presents*

# **Frontiers of Science Forum**

**Friday 24 March 2023**

**Concord Golf Club, 190 Majors Bay Road, Concord**

***Exploring major discoveries and theories in physics, mathematics, biology and chemistry at this year's combined AIP, TGNSW, RSNWS and RACI meeting***

Ever since the Copernican revolution in the 15th century science has been progressing at an exponential rate. Major discoveries and theories in physics, mathematics, biology and chemistry, have shaped and continue to grow at an exponential rate. The Frontiers of Science forum will have a group of international experts to give brief talks on the latest and future developments in their fields of knowledge.

## **Presenters:**

**Honorary Professor Robert Booy, MD, FRACP, FRCPCH**, Professor, Child & Adolescent Health, Sydney University Institute of Infectious Diseases.

**Dr Anna Romanov**, University of New South Wales, School of Mathematics and Statistics.

**Associate Professor David Bishop**, University of Technology Sydney, Hyphenated Mass Spectrometry Laboratory (HyMaS), School of Mathematical and Physical Sciences.

**Associate Professor Susanna Guatelli**, University of Wollongong, Centre for Medical and Radiation Physics and School of Physics.

## **Schedule:**

- 5:15pm Registration and Refreshments
- 6:00pm Welcome – Dr Frederick Osman FAIP FTGN FRSN FACE
- 6:10pm Presentations (25-minutes each)
- 8:20pm Panel Discussion and Q/A with Ian Woolf (Diffusion Radio)
- 9:00pm Vote of Thanks and Close

## **AT A GLANCE**

### **PRESENTERS:**

**Honorary Professor Robert Booy, MD, FRACP, FRCPCH**, Professor, Child & Adolescent Health, Sydney University of Infectious Diseases

**Dr Anna Romanov**, University of New South Wales, School of Mathematics and Statistics

**Associate Professor David Bishop**, University of Technology Sydney, Hyphenated Mass Spectrometry Laboratory (HyMaS), School of Mathematical and Physical Sciences

**Associate Professor Susanna Guatelli**, University of Wollongong, Centre for Medical and Radiation Physics and School of Physics

### **WHEN:**

**Friday 24 March 2023**

### **TIME:**

**5.15pm refreshments  
6.00pm presentations**

### **LOCATION:**

**Concord Golf Club, 190 Majors Bay Road Concord**

### **COST:**

**\$20.00**  
Includes canapés

### **R.S.V.P:**

[Click Here](#) to register online  
By **Wednesday 22nd March 2023**

### **ENQUIRIES:**

Dr Frederick Osman  
0418 318 418  
[president@teachersguild.nsw.edu.au](mailto:president@teachersguild.nsw.edu.au)

## **PRESENTERS AND ABSTRACTS:**

### **Honorary Professor Robert Booy, MD, FRACP, FRCPCH**

#### **Pandemics: Past and Present and Future**

We've lived through 2 pandemics and 7 WHO public health emergencies of international concern in the past 15 years: these are "an extraordinary event which is determined to constitute a public health risk to other States through the international spread of disease and to potentially require a coordinated international response". So many lessons have been learnt with many more to be discerned. I will reflect on 40 years in the field of infectious diseases control.

### **Dr Anna Romanov**

#### **What does = mean?**

Our first taste of maths often involves equality – for what number  $x$  does  $2x+7=5$ ? Equality seems like a straightforward concept, but as we progress, the question of "sameness" becomes more-subtle. What does it mean for two triangles to be "the same"? What about two knots in a piece of string? Settling on a definition of "sameness" is only the first step in understanding a particular mathematical world. With more relaxed notions of equality, it is no longer obvious when two things are the same and when they are different. Given two knots, can you wiggle one until it looks like the other? If the knots are really big, this can be a tricky question to answer! A powerful tool for answering these questions is categorification. Categorification gives mathematicians access to new measurements for distinguishing objects, and is a key technique in many recent mathematical breakthroughs. In this talk, I'll introduce categorification and discuss some of its great successes.

### **Associate Professor David Bishop**

#### **Answering the Elemental Question**

Determining the elemental composition of a sample is important in a wide range of disciplines including in medical diagnostics and environmental applications where it may respectively help us to understand disease progression or toxic metal pollution. Inductively coupled plasma-mass spectrometry, or ICP-MS, is a technique used to measure the concentrations of most of the elements in the Periodic Table, and it is the most powerful elemental benchtop detector available. This presentation will present an overview of how an ICP-MS works, and how advances in the technology are changing how we analyse elements in solids and liquids. It will also provide examples of applications that include detection of nanoparticles in environmental samples, assessing the presence of toxic metals such as mercury and silver in those affected by Parkinson's disease and multiple sclerosis, and in developing alternative biomarkers of disease.

### **Associate Professor Susanna Guatelli**

#### **Human Space Missions to Mars: A Space Radiation Odyssey**

A human mission to Mars, identified as one of the next goals in human exploration, would expose astronauts to serious health hazards caused by exposure to cosmic radiation, eventually leading to cancer and death. The design of shielding solutions and of powerful and accurate radiation monitoring systems are subjects of research to facilitate the human exploration of the Solar System. However, the testing of proposed novel technologies is limited on Earth as there are no accelerator facilities capable to reproduce the complex cosmic radiation field the astronauts would encounter in space. The speaker will show how radiation physics simulation tools can be an effective tool to investigate in-silico the effect of radiation in astronauts, in synergy with experimental research. She will show her work in the field and comment on how this multidisciplinary research, aimed to achieve a sustainable presence of humans in outer space, has impact in our life on Earth.

## **BIOGRAPHIES:**

**Honorary Professor Robert Booy** was until 2 years ago an NHMRC Practitioner Fellow focussing on Vaccine preventable diseases. His funding has exceeded \$30 million, from NHMRC, ARC, Wellcome, QATAR NRF, medical charities, and Industry (about 75 grants). He is a former co-Director of NCIRS, recent Chair of the Immunisation Coalition, and from age 37, was the Chair/HOD of Academic Child Health, Queen Mary, University of London. He has published over 350 times, especially in the fields of influenza/resp viral disease (over 100 papers), invasive bacterial diseases (Hib, pneumococcus, meningococcus) and Covid. For the past 5 years he has consistently had 15 or more papers per year in the medical literature. In 2022, his 2020 LANCET paper on Covid school closure (Viner et al) was deemed in the top 15 in the scientific literature for that year. He has supervised 30 successful Doctorates: half in women, and 10 on infection control at the Muslim pilgrimage, the Hajj. He still supervises 3 doctoral students and 3 others have submitted in the past 12 months. He consults to all vaccine companies in Australia and is the CMO for Vaxxas (one day/week). In the past 3 years, he has done over 3,000 media interviews on infectious diseases: TV, radio, newspapers, on-line. He has a YouTube channel “Prof Robert Booy” and a teaching website ‘Omega.org.au’ for teaching high school science through immunisation and epidemics. In the last 30 odd years he’s done several national lecture tours in both the UK and Australia on serious infection and immunisation. In 2021, he established a charity portal for Unicef, with help from NSW AMA, to promote donations by covid vaccine recipients: over \$90k was raised. In 2021/2 he advised Gen Frewin on the covid vaccine roll-out in Australia.

**Dr Anna Romanov** received her PhD in pure mathematics from the University of Utah in 2018, then immediately traded her mountains for beaches and moved to Sydney for a National Science Foundation postdoctoral fellowship at the University of Sydney. In 2021, she joined the School of Mathematics and Statistics at the University of New South Wales as a tenure track lecturer. Her research is in representation theory, the mathematical language of symmetry.

**Associate Professor David Bishop** is an Associate Professor in Analytical Chemistry at the University of Technology Sydney, where his research focuses on the application of state-of-the-art technology to analytical challenges in a diverse range of disciplines with a particular emphasis on biological and environmental sciences. David has 12 years’ experience in developing and teaching undergraduate analytical chemistry subjects, and in 2023 introduced a Master’s in Science major in Analytical Chemical Technologies. His teaching has a particular focus on gaining hands-on experience in modern analytical instrumentation, and its appropriate use in a wide range of disciplines. He has mentored undergraduate research interns, Honours students, and PhD students during their degrees, and he takes great pride in seeing them develop and apply their theoretical and applied analytical abilities to transdisciplinary tasks, providing them with skillsets that will suit future careers in industry and academia.

**Associate Professor Susanna Guatelli** awarded a PhD in Physics at the University of Genova in 2006. After few years as Research Fellow at the Italian Nuclear Physics National Institute and at the Australian Nuclear Science and Technology Organisation, she became an academic of the School of Physics and Centre for Medical and Radiation Physics, University of Wollongong. Susanna is an international leading expert of radiation transport simulation software tools for radiation physics when applied to bio-medicine, including in radiation protection in Earth labs, aviation and space. In 2021 she was awarded with the prestigious Women in Physics Award of the Australian Institute of Physics, which celebrates female physicists that gave a significant contribution to research in physics. In 2022 she became a member of the ARC (Australian Research Council) Panel of experts. Susanna is very passionate about public outreach activities aimed to inspire the study of physics among the young generations.

**Complimentary Parking:  
Concord Golf Club grounds. 190 Majors Bay Road, Concord**