INTERNATIONAL ACADEMY OF ASTRONAUTICS (IAA)

Sixth IAA Symposium on Search for Life Signatures, March 26th-27th, 2015.

VENUE: IAA Meeting Room, 3rd Floor, 6, Rue Galilee, Paris. Metro: Boissiere.

Rapporteur: Prof. Michael A. Garrett.

Meeting Report

The meeting was attended by around 22 participants, affiliated with various countries around the world including: USA, Australia, The Netherlands, Italy, Russia, Canada, UK and Japan.

Participants of the Sixth IAA Symposium on Search for Life Signatures, held at the IAA on March 26th-27th, 2015

Morning sessions

The meeting kicked-off with a topic related to SETI – the legal protection of the farside of the Moon from man-made interference e.g. RFI – Radio Frequency Interference. This is important for many different scientific pursuits but especially astronomy and SETI research. As the Moon becomes again a target for various international space programmes, this issue is becoming more important. Maccone presented a paper that

proposes to protect an area of the lunar farside that also provides protection from the Lagrangian points – L4 and L5. This will also be important for future low-frequency radio space missions that aim to detect the signature of the Epoch of Reionisation. Maccone has made a presentation to COPUOS in Vienna in 2010 proposing a new radio-quiet zone for the farside of the Moon. However, the political and frequency management issues associated with protection of the lunar farside are complex – for example, the 1979 Moon treaty still remains to be ratified by the major space powers. Nevertheless, the ITU has defined regulations for lunar farside protection. And meanwhile missions such as the joint ESA-Chinese mission DSL (Discovering the Space at the Longest wavelengths) are in preparation. Maccone briefly presented a paper by Sterns & Tennen detailing the complex legal aspects of this activity. A follow-up meeting in Vienna may take place in June 2015.

Penny presented the status of the UK SETI Research Network. In recent times, the UK has not been particularly active in SETI research (searches, theoretical papers etc). The UKSRN has been set up to revitalise the field and provide a forum for discussion. In addition the network aims to promote the SETI research being conducted in the UK, and act as a vehicle for obtaining funding resources. There has been significant media attention to this initiative, and the inventory of SETI research being conducted in the UK has revealed significant activity.

Melis presented on behalf of Montebugnoli et al. the current status of SETI Italia – the only candidate signal was detected in 2006 but has never repeated. The KLT (and other transforms, in addition to the FFT) have been tested on powerful new processors, addressing problems such as RFI rejection. Melis et al. described the new 64-metre Sardinia Radio Telescope (SRT) that is now becoming operational. ROACH2 boards are being used to process SETI observations – piggybacking on standard astronomical projects. The SRT is expected to be active in making SETI measurements towards the end of 2015.

Dumas presented the use of the KLT in its application to Pulsar research. A practical presentation of the KLT was demonstrated by Pari as used at Medicina.

Afternoon Sessions

Optical SETI (OSETI) – an introduction to optical SETI was presented by Savio et al. Moore's law also operating w.r.t. pulsed (nanosec) laser power (e.g. 500TW peak power) – raises possibility of detecting lasers across the Milky Way with relatively modest telescopes (aperture ~ >30 cm). Searches at Italian OSETI observatory (FOAM13) are focused on galactic habitable zone. Rejection of false positives is helped by using 3 photo-multiplier detectors – multiple, separated observatories observing the same target can also be useful to eliminate local false-positives (Cherenkov radiation, satellite reflections etc).

Villa et al. presented the hardware implementation of the OSETI system at FOAM13. The emphasis has been on a system that is based on relatively low-cost COTS equipment and open-source s/w that can also be adopted by other small observatories. In relation to this, an internet-based data sharing and post-processing approach is adopted. Coincidence detection and signal capture is a challenging aspect of the system.

Narusawa presented his ideas about “magic wavelengths” for optical SETI e.g. YAG lasers have a peak output at ~1 micron (NIR), SHG-YAG peaks at 0.5 microns (Optical). NAYUTA telescope is searching for signals at ~ 0.5 micron. Other possibilities are well known absorption lines e.g. Calcium HK break, Halpha, Sodium-D lines etc.

Morris introduced the possibility of discovering ETI artefacts e.g. spacecraft at the Lagrangian points, space mirrors, massive space infrastructures/industrial complexes, sails etc. Attempts to find these (e.g. searches for Dyson spheres) have been tried in the past (e.g. IRAS) and are currently on-going with more recent IR missions (Spitzer, WISE and Herschel). Sails (or other structures) acting as beacons could present simple 2-D or even 3-D patterns that would be immediately identifiable by advanced ETIs as artificial objects.

Klaus explained the current status of SLS (Space Launch System). The ultimate objective is to enable a manned mission to Mars but with significant steps along the way. First launch of SLS is expected in 2018. The initial SLS block 1 has a similar lifting capacity as Saturn V but a significantly larger payload volume. In principle, this new rocket system also opens up new opportunities for the first tentative interstellar missions e.g. Interstellar Explorer, FOCAL etc. SLS could deliver a significant payload to the solar focal point (550 AU from the Sun) in ~ 60 years (with a Solar Electric Propulsion upper stage). The trajectory of the first test flight will be a dress-rehearsal for the first crewed mission in 2021.

Topunov presented the systems necessary for the origin and existence of life. Elemental abundances will be different across the Galaxy – some elements can substitute for others. This may lead to alternate biochemical pathways (even here on the Earth). Possible alternate molecular structures of living forms on Titan are being discussed. Life signatures on other planets could be quite different from the Earth, in particular, the non-detection of Oxygen in Exoplanet atmospheres may not exclude the possibility of life in these systems. Different energetic metabolisms, antioxidant systems etc. may do very well on other planets with other conditions, and also evolve into highly evolved species.

Martinez described the concepts of life before cells. Fundamental questions for astro-biology include: how does life begin and evolve? Does life exist elsewhere in the universe? What is the future of life on Earth and beyond? Convergent evolution is a popular concept in astrobiology today making the case for similar and universal adaptive structures. Likewise a universal mechanism for the creation of all life is suggested e.g. the geo-chemical processes at work around hydro-thermal vents. From what we know of the oceans on Titan and Europa, the environment may be able to generate and support multi-cell life forms. A scenario of staged evolution from pre-biotic-genetic-multi-cellular life was presented.

De Paulis presented the latest news on the New Horizons Message Initiative. The project (now called “One Earth Message” – see www.oneearthmessage.org) is soliciting input from all of Earth’s inhabitants – an allocation of 100MB of images and audio data will be uploaded to the New Horizon’s spacecraft once the main mission is accomplished. There was a discussion about how the project related to METI. There

was concern that the radio signal being sent to the spacecraft by one of the DSN antennas could also be readily interpreted as a powerful METI signal (in addition to the stored message). The spacecraft is on a trajectory outside of the solar system.

Piotelat gave the final talk of the symposium reviewing the role of Cartoons in the history of SETI.