LMU LUDWIG-MAXIMILIANS-UNIVERSITÄT MÜNCHEN

CRC 235
EMERGENCE OF LIFE

life

2019 May Graduate School Meeting

When: Thursday, May 9th 2019
Where: Seidlvilla - Zenzl-Mühsam-Saal, Nikolaiplatz 1b 80802, Munich

Time	Event
11:00-12:30	*Virtual Lab Tours by all students*
12:30-13:00	Coffee Break
13:00-14:30	*General Scientific Training* **by Prof. William Orsi**
14:30-15:00	Coffee Break
15:00-17:00	*Guest Speaker: Talk & Discussion with catered lunch* **Michael Russell** (NASA Jet Propulsion Laboratory - California Institute of Technology) **Why Does Life Start, What Does It Do, Where Will It Be, and How Might We Find It?**
17:00 – open end	*Self-cooking & Dinner, Drinks*

Abstract:

Why Does Life Start, What Does It Do, Where Will It Be, and How Might We Find It?

Michael J, Russell, Interim Employment Program, JPL, NASA

Life was driven into being on our planet to resolve the disequilibria between the fuels H_2 and CH_4 emanating from submarine hydrothermal alkaline springs (pH ~11), as against the CO_2 and NO_x in the ancient atmosphere and dissolved in the acidulous ocean (pH ~5.5). The two fluids – one reduced and the other relatively oxidized – were kept at bay by the precipitation at the spring of iron minerals such as mackinawite (FeS) and the variable valence and pliable green rust ($[Fe^{II}_4Fe^{III}_2(OH)_{12}][CO_3]\bullet 3H_2O$). It was in these mineral barriers that this free energy (redox and pH) was first converted, via a proto-metabolism, to organic molecules. Thus, we can say that life hydrogenated, and still hydrogenates, carbon dioxide. Therefore, we may expect life to emerge on any wet and rocky world that has a partly CO_2-rich ocean. It should reveal itself either as whole cells or as bioorganic molecules that themselves are far-from-thermodynamic equilibrium.

A pedagogical analogy between the alkaline vent site for the emergence of life and rocketry is offered, in that fuels and oxidants in both are somewhat similar as figured below. It is clear, for example, that the rocket is driven by the high entropy exhaust gases generated in the low entropy environment of the combustion chamber. Likewise, it is the waste from the low entropy feeds to life that keep it sustained and working. Indeed, life also uses nano-engines such as Complex 1 and ATPase to couple exergonic reactions to endergonic ones. Thus, life can be said to transcend chemistry,

i.e., it can react hydrogen (or the electrons therefrom), generated geochemically as in hydrothermal convection, or photolytically as in oxygenic photosynthesis to generate a small but ever continuous supply of very particular organic molecules on our planet.