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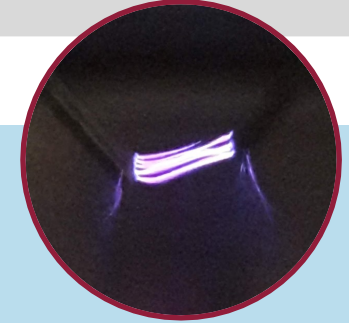
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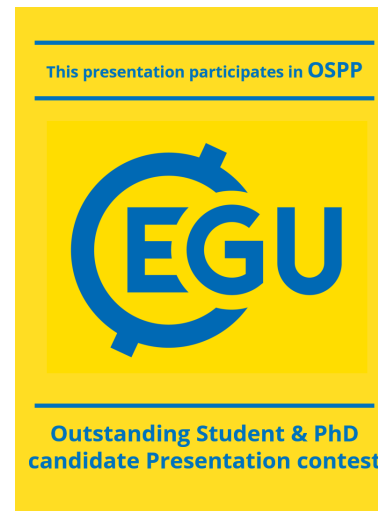
# Nitrogen fixation by lightning and its role for early life on Earth and exoplanets



Patrick Barth  (He/Him)

PhD Student

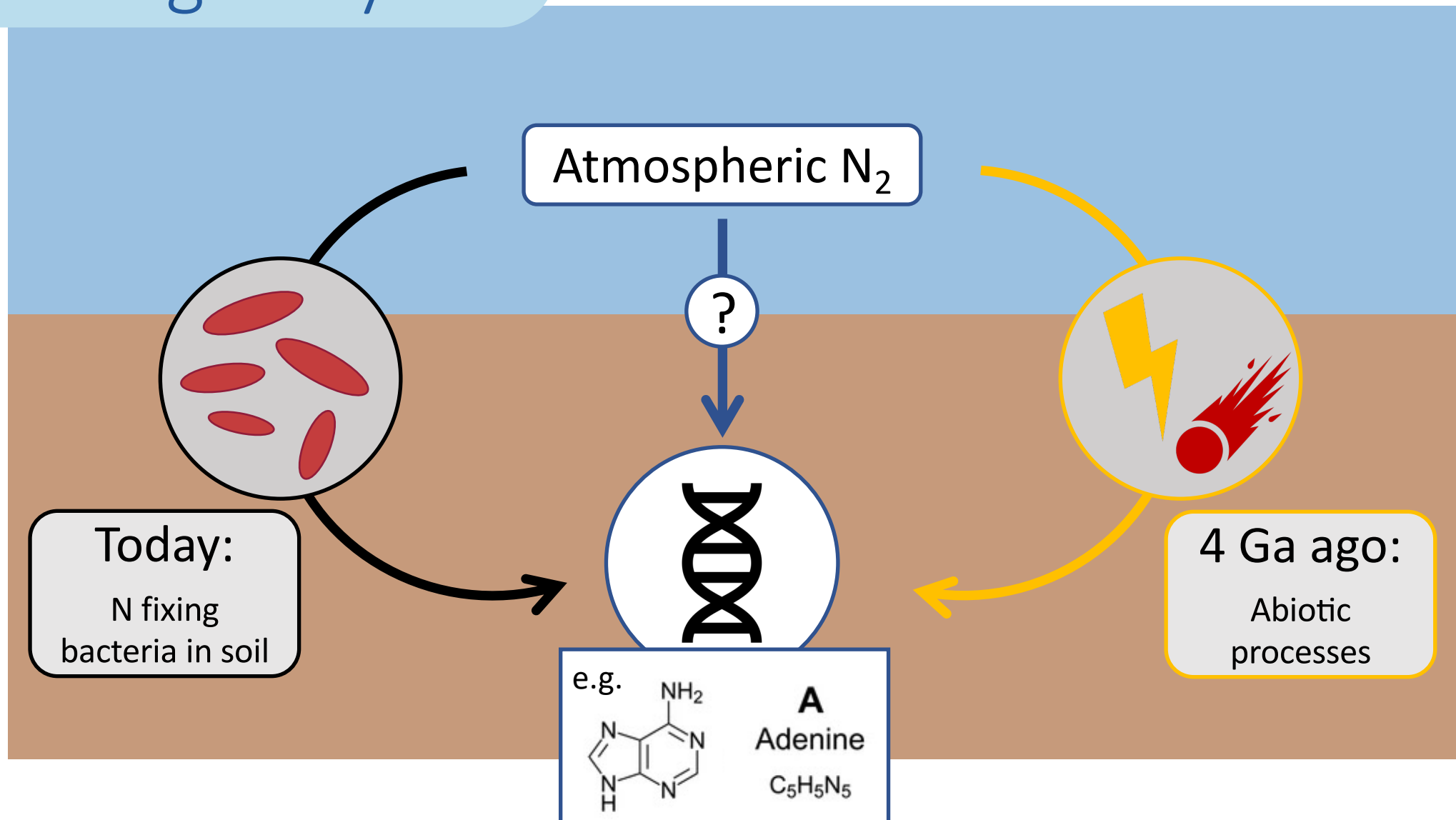
University of St Andrews  
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Graz University of Technology



with Eva Stüeken, Christiane Helling,  
Lukas Rossmannith, Wendell Walters,  
Yuqian Peng, Mark Claire

EGU 2022 – Life as a Planetary  
Phenomenon – 27<sup>th</sup> May 2022

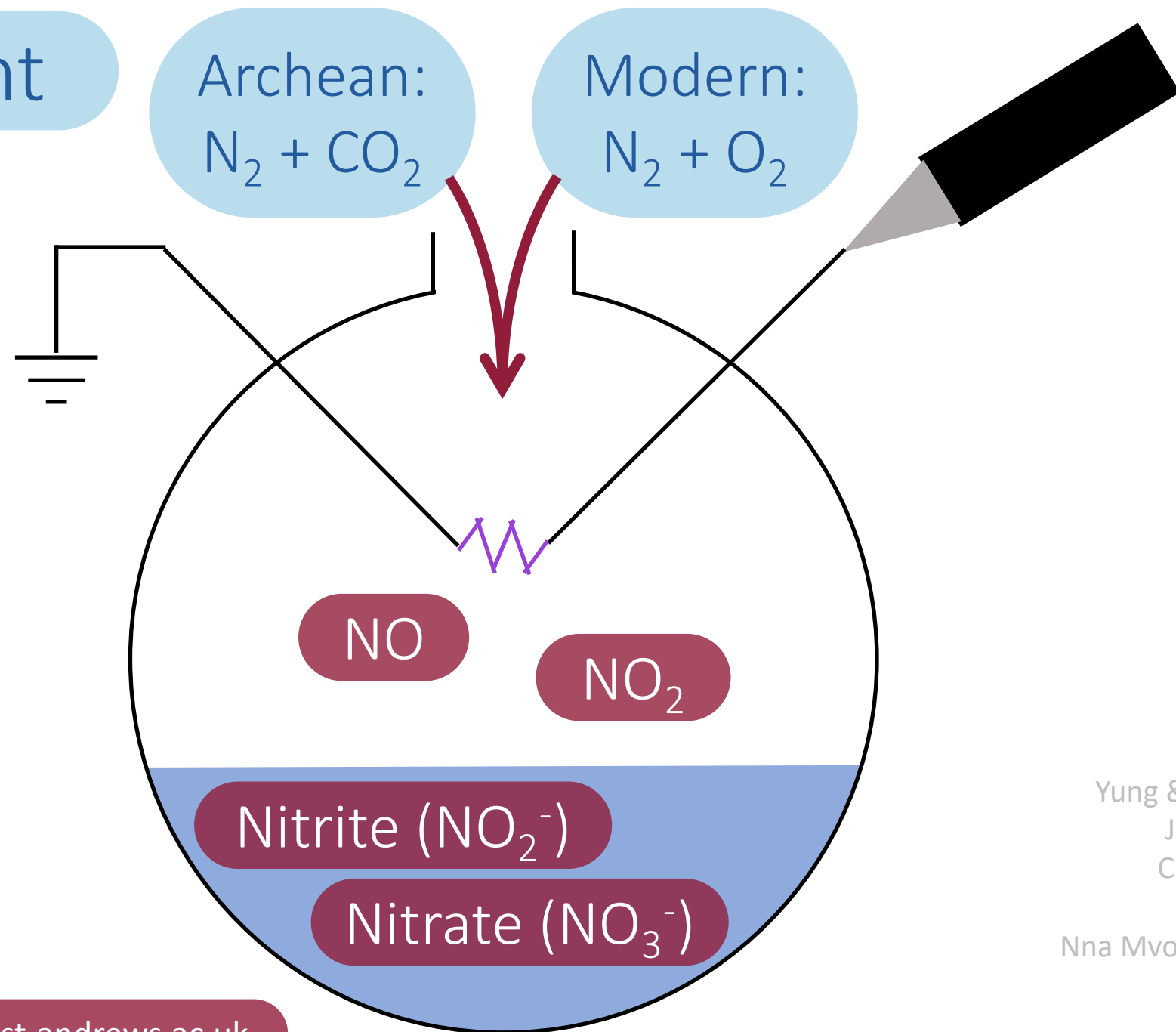
# The Nitrogen Cycle



# The Nitrogen Cycle



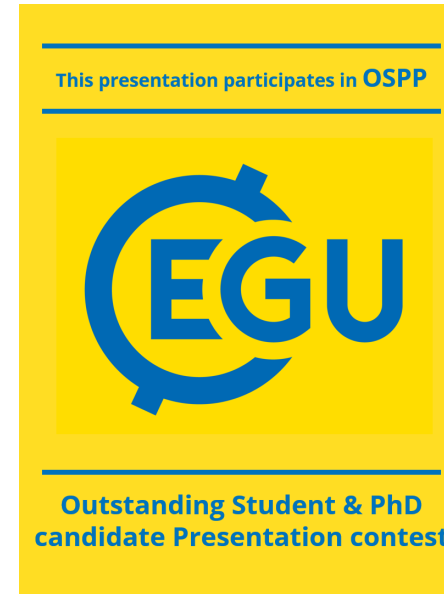
# The Experiment



Yung & McElroy 1979  
Joshi et al. 1985  
Chameides 1986  
Miller 1987  
Nna Mvondo et al. 2001

# Conclusions

- Nitrogen fixation seems equally efficient in Archean ( $\text{N}_2\text{-CO}_2$ ) as in Modern ( $\text{N}_2\text{-O}_2$ ) atmospheres
- Spark experiment can be used to simulate real lightning conditions
- Most N isotope data suggests earlier onset of biological N fixation
- One, corrected sample with potential lightning contribution



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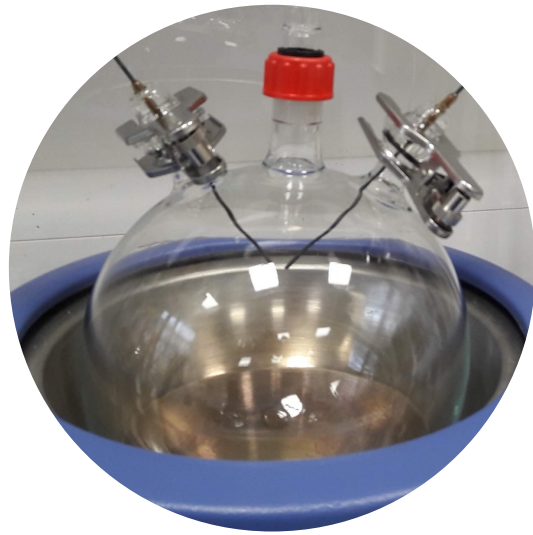


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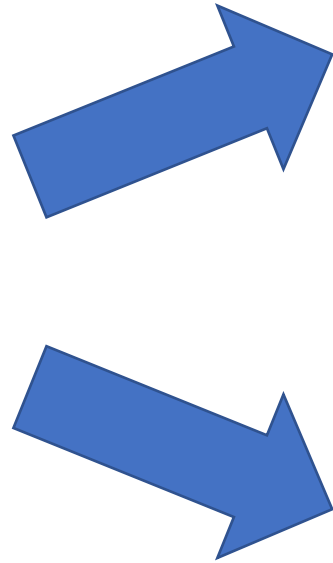
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# Outlook: Simulations



~ 20 cm



~ 12,000 km



~ 160,000 km

## ARGO

1D photochemistry &  
diffusion code

## STAND2019

Atmospheric C/H/N/O  
chemistry

Rimmer & Helling 2016, 2019  
Rimmer & Rugheimer 2019