Viability of Bacterial Spores Under Ocean Worlds Icy Surface Conditions

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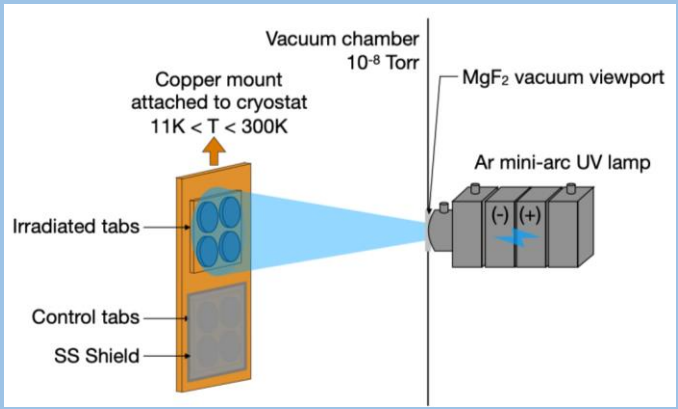
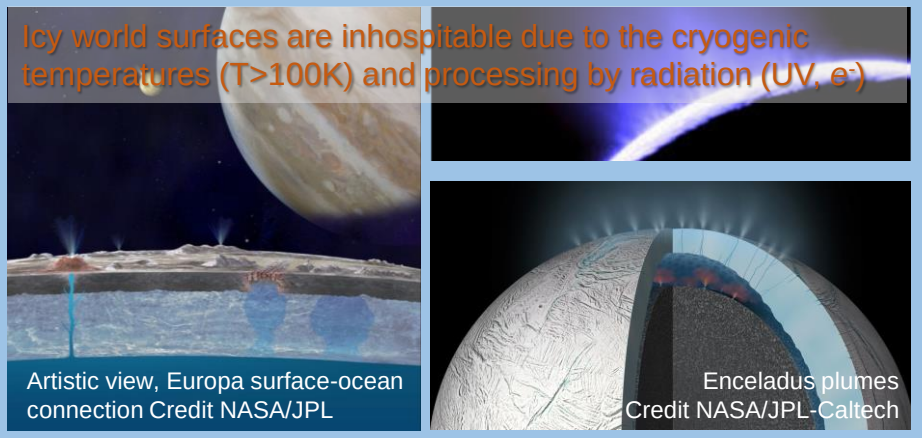
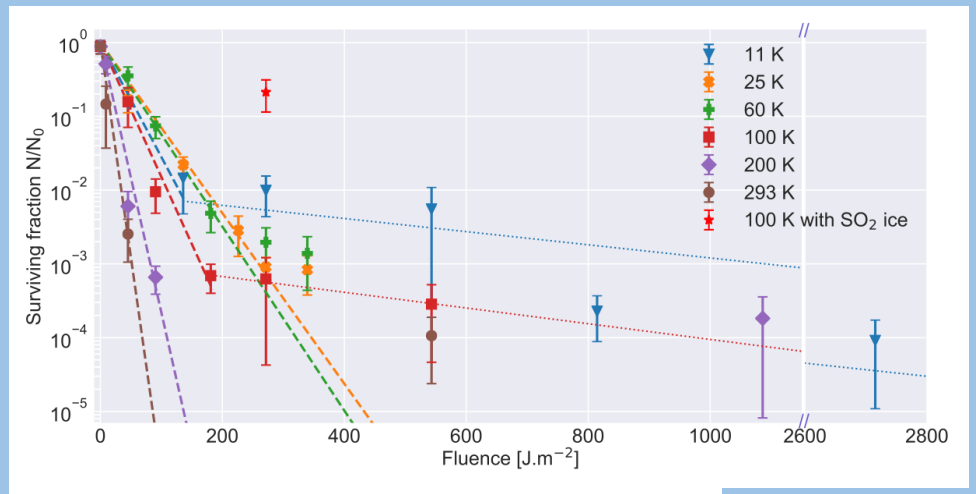
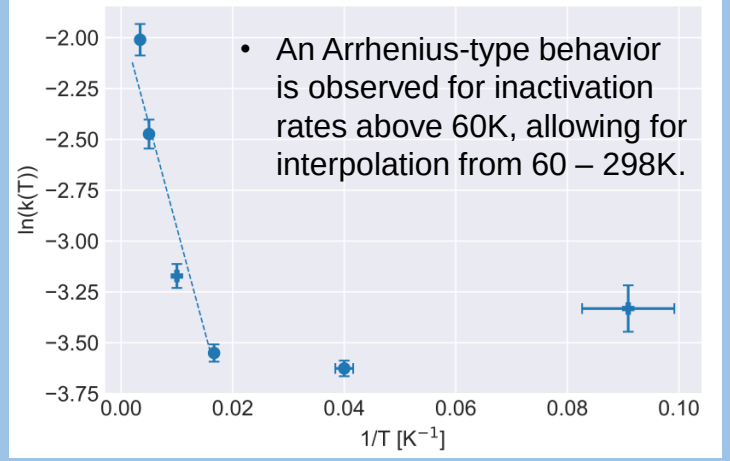


- *B. subtilis* spores were irradiated under high vacuum by UV photons using an Ar mini-arc lamp to mimic the Solar spectrum. They are cooled cryogenically to a temperature between 11K and 300K.
- Spores are deposited onto stainless steel tabs by filter deposition in the sub-monolayer regime to prevent self-shielding, and quantified by culturing.







- The surviving fractions decrease exponentially with fluence, and a more dramatic decrease is observed for higher irradiation temperatures
- At 100 and 11K, the viability kinetics is better fit using 2 exponentials, hinting at the presence of a spore subpopulation with greater UV resistance.

Conclusions

- 99.9% of spores would be inactivated in less than an hour on Europa's surface (100K, 779J.m^{-2}.h^{-1}), and 3 hours on Enceladus (60K, 233J.m^{-2}.h^{-1})
- A layer of absorbing material (SO_2, H_2O_2) as thin as a couple of microns can shield the spores from UV photons.

Up Next!

- Do spore biosignatures such as morphology, fatty acids, amino acid chirality, etc. survive under relevant temperature and irradiation conditions?

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