THE RADIATION STABILITY OF GLYCINE IN H$_2$O-ICE AND CO$_2$-ICE: *IN SITU* LABORATORY MEASUREMENTS WITH APPLICATIONS TO MARS. P. A. Gerakines[1] and R. L. Hudson[1], [1]Astrochemistry Laboratory, NASA Goddard Space Flight Center, Greenbelt, MD 20771, perry.a.gerakines@nasa.gov

Introduction: Planetary bodies of astrobiological interest, such as Mars, are often exposed to harsh incident radiation, which will influence the times that molecules can survive on them. Some or all of these bodies may well contain biologically-important organic molecules, some may even have supported life at some point in their history, and some may support life today. Future searches for organic molecules likely will include sampling the martian subsurface, where organics may be frozen in ices dominated by either H$_2$O or CO$_2$, which provide some protection from ionizing radiation.

The radiation dose received by molecules on Mars is sensitive to depth beneath the exposed surface [1], where galactic cosmic rays and Solar energetic particles (mainly protons) dominate the subsurface particle-radiation environment.

Results: Recently, our research group has published studies of the radiation stability of three amino acids - namely, glycine, alanine, and phenylalanine in both undiluted form and in mixtures with H$_2$O [2, 3]. Here, we focus on the radiation-chemical kinetics of glycine and compare results for its dilution in both H$_2$O and CO$_2$ ices [4]. For each sample, we measured glycine's destruction rate constant and half-life dose due to irradiation by 0.8-MeV protons. All measurements were made *in situ* at the temperature of irradiation using IR spectroscopy. Trends with dilution (up to ~380:1) and temperature (up to ~140 K) are considered, and results are discussed in the context of Mars.

References: [1] Dartnell, L. R. et al. (2007) *Geophys. Res. Lett.,* 34, L0227. [2] Gerakines, P. A., et al. (2012) *Icarus*, 220, 647-659. [3] Gerakines, P. A. and Hudson, R. L. (2013) *Astrobiology*, 13, 647-655. [4] Gerakines, P. A. and Hudson, R. L. (2015) *Icarus*, in press. [5] Hassler, D. M. et al. (2014) *Science*, 343, 1244797.
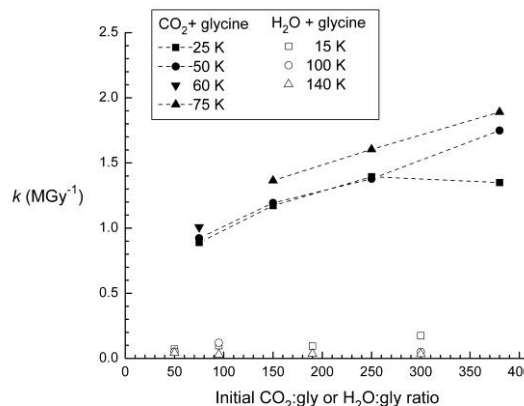
Fig 1. *Glycine destruction rate constants (in MGy^{-1}) for CO$_2$ + glycine samples with different compositions and corresponding data from H$_2$O + glycine ices.*
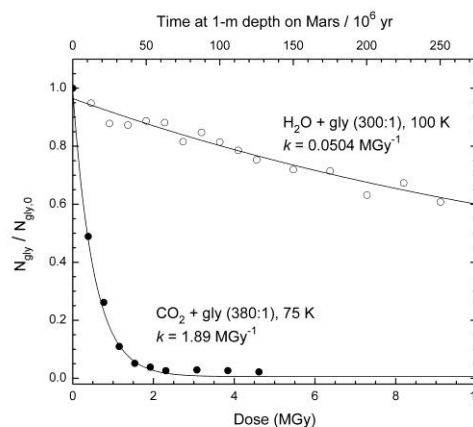
Fig. 2. *A comparison of the surviving fraction of glycine molecules versus dose (in MGy) for glycine diluted and irradiated in two different ices, H$_2$O and CO$_2$. The top axis gives corresponding times at a depth of 1 m on Mars based on the dose rate of 36.4 mGy yr^{-1} (from [5]).*