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Formation of Pre-biotic Molecules in Shocked Astrophysical Ices[1]
NIR GOLDMAN, I-F. WILLIAM KUO, EVAN REED, LAURENCE E. FRIED, LLNL — We present herein *ab initio* molecular dynamics (MD) simulations of peptide bond synthesis in shock compressed astrochemical mixtures such as found in comets and other celestial bodies. Given the likelihood of a CO_2-rich primitive atmosphere, it is probable that impact processes of icy interstellar masses were partially responsible for the creation of pre-biotic peptide (C—N) bonded materials on early Earth. To this end, we have studied C—N bond formation in a prototypical interstellar ice mixture shock compressed up to velocities close to Earth's escape velocity. Our results show that high shock velocities can drive the synthesis of a number of short-lived, exotic C—N bonded species at much high pressure-temperature conditions than previously thought. Stable amino acids are then formed upon quenching to lower temperature. Knowledge of chemical properties of these species under extreme thermodynamic conditions is essential for a complete understanding of the role of these impact processes in the formation of life-building compounds.

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