Strong $^{13}$C depletion induced by solar UV photolysis of CO$_2$ and its implication for early Mars

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We have conducted photochemical experiment and ab initio calculation, both of which demonstrated that solar UV photodissociation of CO$_2$ yields strongly $^{13}$C-depleted CO owing to wavelength-dependent isotope effect. The newly identified large carbon isotope fractionation mechanism implies that the cause of $^{13}$C enrichment of CO$_2$ in early Mars atmosphere should be re-considered in addition to the carbon escape into space. Furthermore, the $^{13}$C-depleted CO should have been converted into aldehydes and carboxylic acids under a reducing early Mars atmosphere, and could have deposited into sediment [1,2]. The expected scenario could explain the observed strong $^{13}$C depletion of some sedimentary organic matter in early Martian sediment [3].