DISSOCIATIVE RECOMBINATION OF D_3S^+: ABSOLUTE CROSS SECTION, BRANCHING FRACTIONS AND ASTROPHYSICAL APPLICATION

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The chemistry of sulfur bearing species in molecular clouds is a very important but still not fully explored field. One of the crucial processes occurring there is a dissociative recombination (DR) of H_3S^+, which is one of the suggested production pathways for H_2S. The DR of D_3S^+ has been studied at the heavy ion storage ring CRYRING in Stockholm, Sweden. It has been observed that the main production channel in this process leads to the formation of DS + 2D, whereas D_2S + D is only a minor pathway. The obtained value for the reaction rate coefficient is 2.8×10^{-7} at 300 K. We used the obtained data to investigate their effect on the predictions of the gas phase and gas-grain model calculations of the sulfur chemistry and deuterium fractionations in dark clouds employing the UMIST code. The results obtained agree well with observations for abundances and deuterium fractionations for several interstellar sulfur compounds. However, large discrepancies are found for H_2S and HCS^+, which are grossly underestimated in both models. We conclude that H_2S is formed mainly on grain surfaces and not through gas-phase reactions in dark clouds.