Water-molecule dissociation by proton and hydrogen impact

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Abstract

Time-of-flight-based mass analysis of charged water fragments have been used to measure the dissociative and the nondissociative reaction pathways of water formed during collisions with 15 to 100 keV and 500 to 3500 keV H+ projectiles and with 8 to 100 keV H0 projectiles. The fragmentation pathways resulting from the ionization and the electron capture collisions with the incident H+ and H0 projectiles, as well as collisions involving projectile electron loss by the incident H0 projectiles, were separately recorded by detecting the target product ions in coincidence with either the ejected target electrons or the charge-analyzed projectiles. The fragmentation profile shows that at high collision energies the ionization of water arises mainly through outer shell processes. At lower energies valence electron capture and ionization dominate and transfer ionization leads to substantially different fragmentation patterns. H0 and H+ projectiles are found to be equally efficient at ionizing the water molecule. These results are of particular interest to workers in astrophysics and those involved in cancer therapy with heavy particle ion beams.

Indexed keywords

Engineering controlled terms: Dissociation; Electron energy levels; Heavy ions; Ion beams; Ionization; Protons

Engineering uncontrolled terms: Collision energies; Electron capture collisions; Fragmentation patterns

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