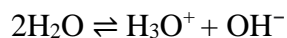


## Mutual Neutralization of $\text{H}_3\text{O}^+ + \text{OH}^-$ experiments at DESIREE

One of the basic mutual neutralization (MN) reactions between molecular ions is the MN of hydronium and hydroxide, which is the inverse autoionization of water:



The balance between these two proton-transfer reactions defines the pH of pure water. However, mutual neutralization of the two ions, isolated from their environment can be considered to most likely proceed via electron transfer, forming an unstable  $\text{H}_3\text{O}^*$  and an OH radical. Recent development of imaging the neutral products of cold MN reactions at the DESIREE facility made it possible to detect the products of such isolated MN reactions. Indeed, we attribute the dominant mechanism to electron transfer, followed by dissociation of the unstable  $\text{H}_3\text{O}^*$  product either into  $\text{H}_2\text{O} + \text{H}$  or to  $\text{OH} + \text{H}_2$ , observed along with a neutral OH radical as an overall three body breakup of the neutral complex. Nevertheless, we observe a significant contribution of two body  $\text{H}_2\text{O} + \text{H}_2\text{O}$  breakup, which can only be attributed to a proton-transfer mechanism. In the meeting we will present and discuss the kinetic energy release distributions of the different product channels that allows to determine the degree of internal energy deposited in the internal degrees of freedom of the molecular products. Furthermore, the long storage times allow to observe the change in the relative e-transfer and proton-transfer yields as a function of storage time and cooling of the ions in the 13K ambient temperature at DESIREE.