Chemical dynamics simulation to suggest possible pathways of formamide synthesis in the interstellar medium

Riccardo Spezia and Antonio Largo

Motivated by the observation of formamide, which is the simplest system presenting a peptide bond, in the interstellar medium [1] and the recent quantum chemistry calculations of Largo and co-workers [2], we have investigated the formation of formamide in the gas phase by using chemical dynamics simulations. In particular, we have investigated theoretically the possibility of reactivity between H_2CO and NH_3OH^+, $NH_2OH_2^+$, NH_2OH, NH_3 and NH_4^+. We have simulated the ion-neutral and neutral-neutral collisions at different relative energies (in the 1-5 eV range) while keeping internal temperature of molecules very cold (15 K). Our simulations show that a formamide synthesis pathway is possible from reaction dynamics in the gas phase when ion-molecule collisions are involved. A possible astrophysical scenario of formation of formamide in the interstellar medium is discussed.

1) R.H.Rubin, G.W.Swenson, R.C.Benson, H.L.Tigelaar and W.H.Flygare, 1971, ApJ, 169, L39
2) P.Redondo, C.Barrientos and A.Largo. 2014, ApJ 780, 181