VUV PHOTOLYSIS OF NH_3: A MATRIX ISOLATION STUDY OF THE MOLECULAR INTERACTIONS BETWEEN AMIDOGEN RADICAL AND AMMONIA MOLECULES

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The presence of NH_3 in the interstellar medium is very promising in terms of possible exobiologically-relevant reactions. This is the reason why numerous laboratory investigations on reactions involving NH_3 were carried out in the context of astrochemistry. Among other reactions, the photolysis of NH_3 was widely investigated. IR spectroscopy in solid phase as well as in rare-gas matrices suggested the formation of NH_2 radicals. In most of these experiments, samples containing NH_3 were prepared at cryogenic temperatures and further irradiated. On the other hand, since the penetration of the photons inside the solid ices as well as inside matrices is limited, the concentration of the photoproducts is weak, thus hindering possible secondary reaction studies. Furthermore, in addition with ice-grain irradiations, in the interstellar clouds, the gaseous species may be subjected to irradiation during their condensation on ice grains. In order to reproduce this effect, instead of irradiating samples obtained by condensation of NH_3 or NH_3/Ne gases at low temperatures, we carried experiments in which irradiation was carried out during the sample deposition. Thus, the amidogen radical and complexes between this radical and ammonia molecules were prepared and isolated in a neon matrix. The formation of $(NH_2)(NH_3)$, $(NH_2)(NH_3)_2$ and $(NH_2)(NH_3)_3$ was clearly established thanks to the comparison between the theoretical and the experimental vibrational frequencies. Thus, such ammonia-containing aggregates may be formed in the interstellar clouds. These complexes, as solvated radicals, may further react with carbon- and oxygen-containing species present on the surface of ice grains. Such reactions may be a first step toward the formation of prebiotic molecules.