Photostability studies of prebiotic molecules at the VUV region

H. Tanaka*†, A. Medina* [1], M. G. P. Homem‡, L. A. V. Mendes*, F. V. Prudente*, and R. R. T. Marinho* [2]

* Universidade Federal da Bahia, Instituto de Física, Salvador, 40210-340 BA, Brazil
† Instituto Federal de Educação, Ciência e Tecnologia da Bahia, Porto Seguro, 45810-000 BA, Brazil
‡ Universidade Federal de São Carlos, Departamento de Química, São Carlos, 13565-905 SP, Brazil

Synopsis In this work we report absolute cross section studies of prebiotic molecules measured in the VUV range using the double ion chamber technique and synchrotron radiation. Absorption, ionization and neutral decay cross sections will be presented, together with the absolute ionization quantum yield. Additionally, partial ion yield spectra were measured by a TOF mass spectrometer.

The space between stars, the interstellar media (ISM), is a vast source of raw material that can originate stars and planetary systems. It also can be a reservoir of remaining particles from extinct stellar systems. This tenuous distribution of matter, consisting of grains and molecular gases, corresponds to about 10% of the Milky Way material. The photodissociation of simple molecules and their subsequent recombination with free radicals, resulting in new complex species, is an important process in the chemical evolution of molecules formed in space.

In this context, we have studied some astrophysical interesting species exposed to vacuum ultraviolet radiation (VUV). Their photoexcitation and photoionization processes can improve the knowledge of photodegradation, and consequently, of photostability.

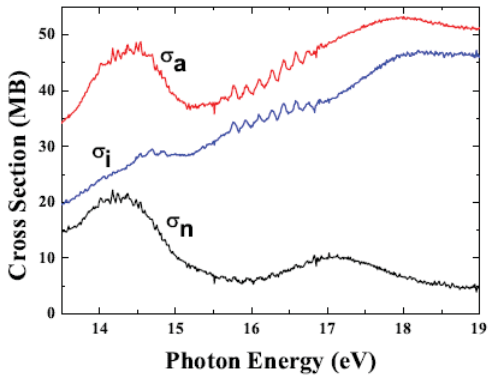

Figure 1. Photoabsorption (σ_a), photoionization (σ_i) and neutral decay cross sections (σ_n) for Formic Acid.

It will be presented the absorption, photoionization and neutral decay cross sections of prebiotic molecules like formaldehyde, formic acid and others, in the VUV region, from 13.5 eV to 19.0 eV, that corresponds to the vacuum ultraviolet radiation coming from the Sun. As an example, these cross sections and the absolute ionization quantum yield for formic acid are shown respectively in Figs. 1 and 2.

Our measurements were performed at D05A-TGM beamline of Brazilian Synchrotron Light Laboratory (LNLS). For cross section measurements we have used a dual ionization chamber [1]. Furthermore, we have measured the partial ion yield spectra of these molecules with a time-of-flight mass spectrometer (TOF) [2].

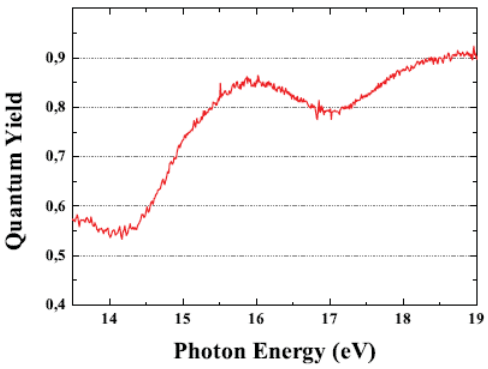

Figure 2. Absolute ionization quantum yield for Formic Acid.

References

[1] Homem M G P *et al* 2012 *J. Chem. Phys.* **137** 184305
[2] Burmeister *et al* 2010 *J. Electron Spectrosc. Relat. Phenom.* **180** 6

[1] E-mail: aline.medina@ufba.br
[2] E-mail: rtmarinho@ufba.br