# 25th RAU
# ANNUAL USERS MEETING LNLS/CNPEM

**September 16th and 17th, 2015**

http://pages.cnpem.br/rau/

LNLS Laboratório Nacional de Luz Síncrotron

CNPEM

Ministério da Ciência, Tecnologia e Inovação

GOVERNO FEDERAL BRASIL PÁTRIA EDUCADORA

# The use of synchrotron radiation in Astrobiology: Lithopanspermia studies and the Biosun project

Presenter: Abrevaya X. C.

Abrevaya, X. C.[1,2]; Galante, D.[3]; Nóbrega, F.[4]; Tribelli, P.[5]; Rodrigues, F.[6]; Araujo, G.[7]; Gallo, T.[3]; Ribas I.[8]; Sanz-Forcada, J.[9]; Rodler, F.[10,11]; Porto de Mello G.F.[12]; Leitzinger, M.[13]; Odert, P.[13]; Hanslmeier, A.[13]; Horvath, J.[2]

*[1] Instituto de Astronomía y Física del Espacio (IAFE), UBA – CONICET, Buenos Aires, Argentina; [2] Research Unit in Astrobiology, IAG – USP, São Paulo, Brazil; [3] Brazilian Synchrotron Light Laboratory (LNLS/CNPEM), Campinas – SP, Brazil; [4] Instituto Oceanográfico, USP, São Paulo, Brazil; [5] Depto de Química Biologica, FCEyN – UBA, IQUIBICEN – CONICET, Buenos Aires, Argentina; [6] Instituto de Química, USP, São Paulo, Brazil; [7] Programa de Pós-Graduação em Biotecnologia ,ICB/USP, São Paulo, Brazil; [8] Institut de Ciencies de l'Espai, Barcelona, Spain; [9] Centro de Astrobiología, Madrid, Spain; [10] Max-Planck-Institut für Astronomie, Heidelberg, Germany; [11] Harvard-Smithsonian Center for Astrophysics, Cambridge, USA; [12] Observatorio do Valongo, UFRJ, Río de Janeiro, Brazil; [13] Institut für Physik, IGAM, Universität Graz, Graz, Austria*
abrevaya@iafe.uba.ar

Panspermia theory assumes that microscopic life forms (e.g.: microorganisms) could survive long interplanetary travels (Arrhenius, 1903; Hoyle and Wickramasinghe, 1979). This has been matter of debate since a long time ago, opening the possibility of an extraterrestrial origin of life on the Earth. One of the open issues is that it is still not known if these life forms could survive these travels because they would be exposed to multiple extreme conditions (e.g.: radiation, vacuum). Abrevaya et al (2011) showed the capacity of some species of microorganisms to survive several doses of VUV radiation and vacuum as those related to the conditions of low Earth orbit (L.E.O.). In a new round of experiments performed at the TGM beamline (LNLS, Campinas, Brazil) we tested the survival of the microorganisms considering Lithopanspermia (interplanetary transfer of life through meteorites) in the context of the BioSun project (Abrevaya et al., 2013). The Martian meteorite "Nakhla" was chosen as model for these studies because it contains halite inclusions (NaCl evaporitic minerals). This is connected to the fact that microorganisms known as haloarchaea were found entrapped inside ancient halites (250 Mya) on Earth (e.g.:McGenity et al., 2000); therefore these organisms were proposed as possible inhabitants of Mars and possible candidates for the interplanetary transfer of life (Stan-Lotter et al., 2004). As the project is focused in the radiation environment of the young Sun, for the simulation experiments we selected as main parameters low pressure (vacuum) and VUV radiation as those we could found in L.E.O. around 3.8 Gyr ago. Two species of haloarchaea and the radioresistant bacteria D. radiodurans were entrapped inside halites and irradiated with VUV (57.5 –124 nm) with different doses up to 40000 J/m2 (eq. to 10 days in L.E.O.). We showed that the survival of of the microorganisms is strongly dependent on the specie and that halites could not offer enough protection.

Abrevaya XC, Paulino-Lima IG, Galante D, et al. 2011. Astrobiology, 11, 1034-1040. Abrevaya XC, Hanslmeier A, Leitzinger M, et al., 2014. The BIOSUN project: an astrobiological approach to study the origin of life. REVMeXAA 44: 144-145. Arrhenius, S. 1903. Umschau 7:481–485. Hoyle F. and Wickramasinghe NC.1979. Diseases from Space. Harper and Row, New York. McGenity TJ, Gemmell RT, Grant WD, Stan-Lotter H. 2000. Environ. Microbiol. 2:243–250 Stan-Lotter H, Radax C, McGenity TJ, et al. 2004. From intraterrestrials to extraterrestrials - viable haloarchaea in ancient salt deposits. Halophilic Microorganisms, edited by A.Ventosa, Springer Verlag, Berlin, Heidelberg, New York, pp.89-102.