PHOTOSYNTHESIS AND ITS IMPLICATIONS FOR SPACE RESEARCH. J. P. P. de Vera[1], T. Leya[2], A. Lorek[1], A. Koncz[1], R. de la Torre Noetzel[3], N. Kozyrovska[4], O. Burlak[4], B. Foing Author[4], [1] Insitute of Planetary Research, DLR e.V., Department of Experimental Planetary Physics, Rutherfordstr. 2, 12489 Berlin, Germany, jean-pierre.devera@dlr.de, [2]Fraunhofer IBMT, CCCryo – Culture Collection of Cryophilic Algae, AG Extremophile Research, Am Muehlenberg 13, 14476 Potsdam-Golm, Germany, thomas.leya@ibmt.fraunhofer.de, [3]INTA, Dpm. Observación de la Tierra, Crta. Ajalvir, km. 4, 28850 Torrejón de Ardoz, Madrid, Spain, torrenr@inta.es, [4]Institute of Molecular Biology&Genetics of NASU, Kyiv, 03680, Ukraine, kozyrna@ukr.net, [4]SA/ESTEC/SCI-SR, Noordwijk, The Netherlands, Bernard.Foing@esa.int

Photosynthesis in evolution and oxygen as biosignature: Photosynthesis has been developed on Earth about 3.5 Billion years ago by cyanobacteria. These first photosynthesizing organisms have transformed our Planet by its oxygen production and triggered the follow on evolution of all other organisms. The presence of ozone in the upper terrestrial atmosphere is due to the fact that in the Early Earth cyanobacteria have produced the essential oxygen molecules. For this reason oxygen, especially ozone could also be used as biosignature for the search for life on extra-solar planets in the universe.

Space/ Space simulation experiments: Current results are demonstrating the fact, that some photosynthesizing life forms are also able to resist space parameters as UV radiation and vacuum after space exposure. This has been shown by experiments on BIOPAN 6 on the satellite FOTON M3 and by space simulation tests [1]. New results obtained by the recent space experiment "LIFE" on EXPOSE-E/ISS lead to the same conclusions. Surprisingly for some organisms photosynthesis seems to work in a Martian environment with low water supply or in frozen environments up to – 30° C. Simulation tests producing a Martian atmosphere and low pressures down to 6-11 mbar in the Mars simulation chamber HUMILAB (DLR Berlin) have shown these observations [2]. It seems that for some terrestrial organisms in presence of liquid or even frozen water the Martian atmosphere, radiation, low temperature and low pressure will not be the limiting factors for relevant life processes to be conducted by the photosynthesizing microorganisms.

These matters of facts are implicating the question if CO_2-rich atmospheres on other extra-solar planets may probably just hide existing photosynthesizing organisms because of the incorrect evolutionary time window and misinterpretation of data (e.g. high CO_2 concentration), we would get from new discovered planets.

Implications for space research: On the other hand the research on photosynthesis in future space investigations is prerequisite for a successful development of life supporting systems in manned space flight missions. By photosynthesis plants are able to produce oxygen for breathable air and food. The use of plants in space is also an important psychological factor for astronautic crews because of refreshing and breaking up the appearance of the interior of future space stations in orbit or on other planets. Therefore photosynthesis might play a key role for technical use in future space exploration missions.

References:

[1] de Vera J.P.P. et al. (2009) *Astrobiology* (accepted). [2] de la Torre et al. (2009) *Icarus* (subm.)