POSSIBLE IDENTIFICATION METHOD FOR MARTIAN SURFACE ORGANISMS BY USING A NEW STRATEGY OF NANO-ROBOTS. Vizi, P.G.[1], Dulai, S.[2], Marschall, M.[2], Bérczi, Sz.[3], Horváth, A.[4], Hudoba, Gy.[5] Pócs, T.[2]. [1]Wigner Institute, H-1121 Budapest, Konkoly-Thege u. 29-33., Hungary, [2]Esterházy College, Inst. Biology, H-3300 Eger, Leányka u. 6. Hungary, [3]Eötvös University, Inst. Physics, H-1117 Budapest, Pázmány P. s. 1/a. Hungary, [4]Konkoly Observatory, H-1121 Budapest, Konkoly Thege M. u. 15-17. Hungary, [5]Óbuda University, Alba Regia Center, Székesfehérvár, Hungary.

Introduction - Measuring theoretical recent life activity on Mars: Earlier studies revealed that the seasonal defrosting mechanism of the Dark Dune Spots (DDS) may be interpreted by events not only of defrosting and thawing processes but may involve activity of recently living Martian Surface Organisms, the MSOs (Horváth et al 2001, Gánti et al. 2003) [1, 2]. Looking for terrestrial counterparts for MSOs have resulted in recognitions of extremophile bacteria and according to the suggestions of Pócs et al (2004) the main characteristics of the MSOs and their terrestrial counterparts are in coherence with those of the so called Crypto-Biotic Crusts (CBCs). The most important constituent of the terrestrial CBCs are the Cyanobacteria (Pócs et al 2004) [3]. We propose that measuring of the main actors of the CBCs, the photosynthesizing cyanobacteria on the surface of Polar Mars should be a promising way of identification of Martian life. So if our goal is to find recent life on Mars, it can be tried by measuring energy transforming processes of the probably existing cyanobacteria on Mars..

Measuring proposal: Terrestrial experiments showed that photosynthesis of classical chlorophyll-containing plants can be measured according to the fluorescence emitted by the living plants. If Martian CBC-like living organisms emit fluorescence this effect can be measured on Martian near surface by an instrument which contains the miniaturized version of the fluorescence measuring subsystem. Moreover, the multiple pieces of such subsystem should be delivered and scattered on the Martian surface by a space probe.

Earlier works of Vizi (2012a) and Vizi et al (2012b) [4, 5] has shown that a new strategy of measuring surface parameters can be carried out by using dispersed „sugar cube" sized mini-satellites, or mini-space probes. These units, like earlier the penetrators planned for Mars Polar Lander, should be thrown out from a landing space probe and this way they would be distributed on a large surface area. On the surface the measuring units start measuring the light energy capture and utilization processes of MSOs by the method, mentioned earlier. The data from the „sugar cube" measuring subsystems would be collected by the orbiting probe, or should be sent parallel onto the orbiting space probe sent with the mission or earlier deposited around Mars.

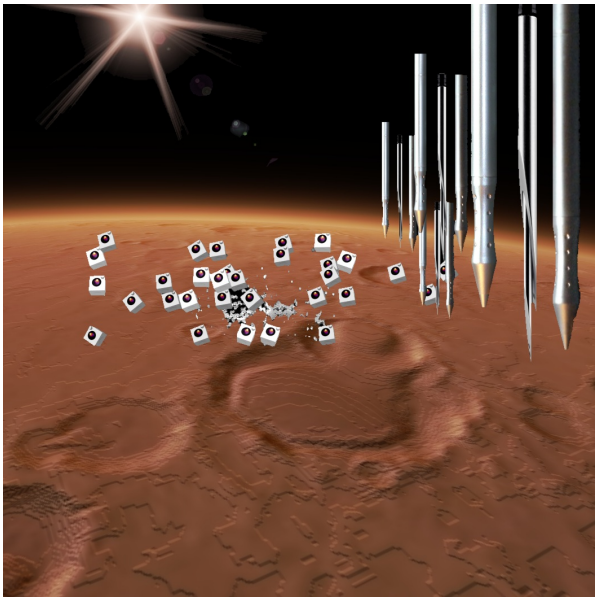

Fig. 1. NPSDR nano probes above Richardson Crater

Target region: The target region to show these MSO photosynthesizing units are on the Dark Dune Spot, which spring began to exhibit living signals. The dormant MSOs get sunshine and begin to work and the sugar cube measuring units should be scattered and deposited into the dark region of the DDS. Such regions can be found int he 50-85 degrees latitudes of the southern hemisphere of Mars.

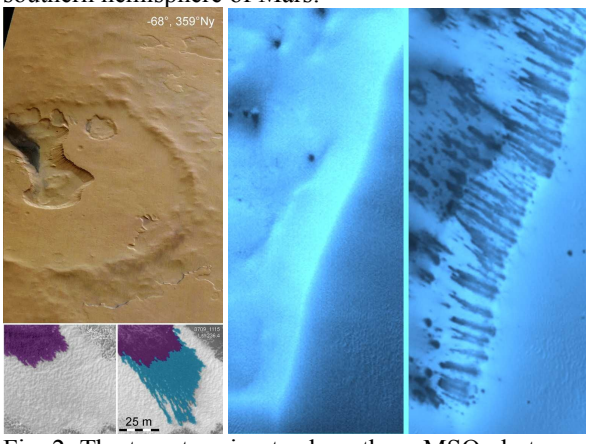

Fig. 2. The target region to show these MSO photosynthesizing units are on the Dark Dune Spot (Horváth et al.) [6].

Measuring method: On the Earth the photosynthesis of cyanobacteria is tightly connected to other life processes and their photosynthetic activity is measur-

able by the chlorophyll fluorescence induction. Although, phycobilines also take a part of fluorescence in these organisms this method widely used not only to detect their photosynthetic activity but also it provides valuable information on their overall physiological status (Campbell et al. 1998) [7]. Under the earthly circumstances chl. fluorescence quenching analysis allows rapid and non-invasive measurement of key phenomena of photosynthetic light capture and electron transport processes. In the case of hypothetical MSOs, if they use the light energy for their life processes, a similar system might provide a proper method theoretically for the detection some features of their hypothetical energy transformation. In case, a pigment system absorbs a given frequency range of electromagnetic radiation, like on the Earth the photosynthetic pigment molecules, some characteristics of the use and transforming of excitation energy can be detected by a similar measuring system like fluorescence induction.

Nano-sized robots: All of necessary measuring systems are available in small enough size. With nanotechnology the size can be kept in a cubic inch range, e.g. light sources, spectrum of LEDs, the sensors, the photo diodes. Their low energy consumption for several milliseconds flashes during 5-10 minutes of operation.

Distribution map of NPSRDs: Over the distribution of NPSDR (as described in previous papers of Vizi et al. 2012) [4,5] the positions of NPSDRs are necessary to know.

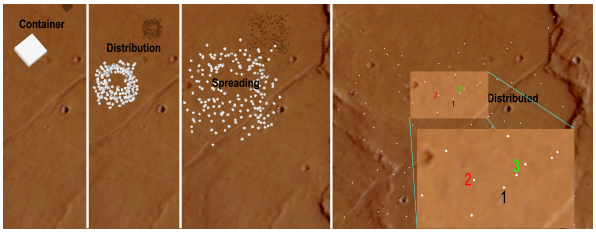

Fig. 3. Distribution of NPSDR. [4,5]

Additional aim of this article is to show the method of how to known the ultimate deposition of the NPSDRs. The 'distribution matrix map' is basically programmable. During the fall the random ramble of NPSDRs occurs and the matrix becomes mixed. To recalculate random changes every NPSDR have an identification number, a transmitter and a receiver. Every NPSDRs are sending its own identifier number, step by step, in equal time interval (according to the launch timing). In the intervals of their signals sending they all are listening and receiving the signals of the other NPSDRs. All these data are recorded and will be transmitted during broadcasting period of collected data. (The signal strength is measurable and proportional to the distance.)

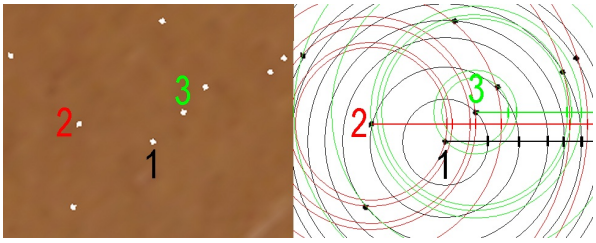

Fig. 4. Position map from relative distances

Summary We have shown new ideas coming from nano technology and presented possible types of NPSDR. We summarized ideas how to detect and measure surface characteristics on planetary surfaces. In addition, we demonstrated one specific instrumental furniture for detection of living organisms at the dark dune spots during their seasonal defrosting changes. Our proposal is to put two containers of NPSDR onto a Mars space probe. During orbital maneuvers and landing the space probe drops the NPSDR units onto the Northern or Southern Polar Region of Mars.

References: [1] Horváth A., Gánti T., Gesztesi A., Bérczi Sz., Szathmáry E. (2001): Probable evidences of recent biological activity on Mars: Appearance and growing of Dark Dune Spots in the South Polar Region. In *Lunar and Planetary Science XXXII*, Abstract #1543, [2] Tibor Gánti, András Horváth, Szaniszló Bérczi, Albert Gesztesi, Eörs Szathmáry (2003): Dark Dune Spots: Possible Biomarkers on Mars? *Origins of Life and Evolution of the Biosphere*. 33. No. 4-5. pp. 515-557. [3] T. Pócs, E. Szathmáry, Sz. Bérczi, A. Horváth, T. Gánti, Á. Kereszturi (2004): Cryptobiotic Crust Types, as Earthy Analogues of Possible Martian Life Forms. *4. EANA Conference*, 2004 November, Milton Keynes; [4] Vizi, P., Horváth A., Hudoba Gy., Bérczi Sz., Sík A.. (2012): 'Lump Sugar and Salt Shaker'-Like Nano and Pico Space Devices and Robots. International Workshop on Instrumentation for Planetary Missions, 2012, okt. 10-12. Greenbelt, Maryland. USA; [5] Vizi, P., Horváth A., Hudoba Gy., Bérczi Sz., Sík A.. (2012): Meteorite Like Nano and Pico Space Devices and Robots and the Polar Region of Mars. The Third Symposium on Polar Science, http://www.nipr.ac.jp/symposium2012/program/Met/E34_M_PalVizi_2.pdf [6] A. Horváth, Á. Kereszturi, Sz. Bérczi, A. Sik, T. Pócs, T. Gánti and E. Szathmáry (2009) Analysis os Dark Albedo Features on a Southern Polar Dune Field of Mars, *Astrobiology 9*, No.1, pp. 90-103. [7] Campbell et al (1998): Microbil Mol Biol Rev. 62 667-683.