Chromatic Complementary Adaptation (CCA) for the exploration of Exoplanetary Life

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The purpose of our research is astrobiological modeling of possible living processes on exoplanets. Imitations of exoplanetary systems have significant theoretical and practical value.

Modeling in astrobiology involves: Selection of exoplanets suitable for origin of life; Theoretical modeling of exoplanetary environment with polarization-holography methods; Imitation of Stellar spectra and experiments with Chromatic Complementary Adaptation; Laboratory modeling of the ecosystem and alien life.

The main problem is the integration of investigations both in Astrophysics and Biotechnology. We have showed for the first time the possibility and expediency of such approach, for the solution of astrobiological problems.

Theoretical discussions and results obtained from our experiments demonstrate that inhabited planetary bodies should obviously exist among those known for today, revealing unusual environmental conditions and providing unique evolutionary development and biological diversities.

Investigations in biotechnology are focused on Complementary chromatic adaptation (CCA), consequence of the adjustment of the chromoprotein composition of the photosynthetic light-harvesting antenna system. Changes in light properties and light-harvesting structure help the cells maximize or minimize the absorption of prevalent wavelengths of light in the environment and maintain various rates of artificial photosynthesis and oxygen generation. That is the most valuable method that can provide useful tools for farther manned space missions.

Bearing in mind that chromatic adaptation involves gene regulation, gives us the possibility to create transgenic organisms adapted to required illumination conditions on exoplanets.

Modeling of star spectra, selection of adapter pigments (or other light-harvesting complexes) and synthesis of the artificial photosynthetic film, in future could provide oxygen supply for space stations, space ships, Lunar and Martian colonies.