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Interactive comment on "Fundamental molecules of life are pigments which arose and evolved to dissipate the solar spectrum" *by* K. Michaelian and A. Simeonov

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General Comment: 1. It is written in the abstract: . . .the thermodynamic imperative

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of increasing the entropy production of the biosphere... o Comment. Can entropy be produced? o Comment. Additionally, each living organism in the biosphere internally reduces its entropy. Since these organisms are part of the biosphere, how does this add up to an increase in biosphere entropy? Did the auhtors take account of this phenomenon?

Specific Comments: 2. It is written on page 2112 (15): From this thermodynamic perspective, one would expect the history of pigment appearance and evolution to be correlated with the evolution of the solar spectrum at Earth's surface. o Comment: Do the authors suggest here that the history of pigment appearance and evolution has taken place outside living organisms or within the biophysical context of a living autotroph or semi-autotroph?

3. It is written on page 2112 (20): ...an important hallmark of the evolution of life on Earth is the proliferation of organic pigments over Earth's surface... o Comment: Are we dealing here with the proliferation of organic pigments over Earth's surface or the proliferation of living organisms carrying organic pigments over Earth's surface? It is my opinion that living organisms are the drivers of proliferation since a pigment cannot reproduce itself. Proliferation is a typical property of living organisms. It are the first autotrophs that colonized the Earth's oceans (most probably), not their pigments on its own, but always embedded in the organisms biophysiscal structures (membranes). It is only in that context that thermodynamics have to be considered as well, and not outside the organism except maybe the ecosystem it lives in. o Therefore I would replace pigments or organic pigments everywhere in the manuscript by pigment containing organisms.

4. It is written on page 2113 (25): ...the fundamental molecules of life (nucleic acids, aromatic amino acids, enzymatic cofactors) are actually organic pigments in the UVC-UVB range. o Comment: I have a problem with the expression 'organic pigments in the UVC-UVB range. I assume the authors intend to express that nucleic acids, aromatic amino acids and enzymatic cofactors absorb and dissipate solar radiation in

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the UVC-UVB spectral range. o Comment: I don't consider nucleic acids, aromatic amino acids and enzymatic cofactors as pigments, but as organic molecules. It is my opinion that an organic pigment has to absorb (and dissipate) electromagnetic (EM) energy in the visible part of the solar spectrum to be named a pigment, at least in chemical terms. If not, one simply speaks of organic molecules, not pigments. A pigment is a material that changes the color of reflected or transmitted light as the result of wavelength-selective absorption in the visible part of the spectrum. Hence a pigment is by definition visible by the human eye and this terminology is not chosen by coincidence, but by the biochemistry of human vision and the photosynthetically active part of the solar spectrum, the PAR spectral region from 400 to 700 nm.

5. It is written on page 2114 (15-20): Therefore, the coupling of nucleobase photon dissipation to the water cycle... o Comment: I do see the contribution of nucleobase photon dissipation to the evaporation of water. But how does this lead to a coupling with the water cycle? What hydrological process balances out the mass of evaporated water so that one can actually speak of a water cycle with a closed mass balance? Precipitation? And if it is precipitation, wouldn't the Earth's atmosphere in that case not be covered with dense clouds? And do dense clouds not attenuate solar radiation drastically? Hence, the solar radiation reaching the Earth through the atmospheric windows, wouldn't it be strongly determined by the balance of this Hadean ocean primitive hydrological cycle?

6. It is written on page 2115 (5): ...cystine (Pace et al., 1995; Edelhoch,1967)... o Comment: cystine. Isn't it cysteine which is meant here?

To be continued...

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