

Chiral photons as trigger of life's asymmetry?

Wednesday, 1 October 2014 11:00 (25 minutes)

All life on Earth is defined by its asymmetry –both our genetic material and our proteins have a “twist” inherent within their structure. Understanding how this asymmetry initially arose is a key question related to intimate processes at the origin of life. Given the detection of circularly polarized light in star-forming regions and the identification of amino acids from meteoritic samples which possess measurable enantiomeric excesses of the naturally occurring left-handed form, it is reasonable to postulate that interstellar/circumstellar asymmetric photochemistry could have introduced the initial chiral biases into key biomolecular building blocks. From cometary ice simulations, advanced carbonaceous meteorite analyses and chiroptical properties in the vacuum-UV of target molecules to the use of circularly polarized synchrotron light, we will present our current research investigating the generation of chirality and asymmetry. We will specifically focus on our recent work on the asymmetric photolysis and photosynthesis of amino acids in pre-cometary ice analogues and discuss its important implication for understanding the origins of homochirality in living matter.

Figure 1. (Click: abstract files on the right). Energy-tunable asymmetric photolysis. (a) Anisotropy spectra $g(\lambda)$ of isotropic amorphous D alanine (red) and L-alanine (blue) in the vacuum UV and UV spectral region. (b) Photolytic induction of ee values into amino acids in the amorphous solid state as function of circularly polarized light (CPL) energy and helicity.

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Session Classification: Session 5 Astrochemistry (Nahon)