Harnessing energy for chemistry from solar radiation

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Sunlight is the energy source for determining the Earth's climate and driving its chemistry. The planet's overall radiative budget is determined by the balance of incoming and outgoing solar radiation, which is in part affected by absorption and reflection from atmospheric aerosols and clouds. Overwhelming observational and laboratory evidence has accumulated to suggest that organic molecules play an important but not yet well understood role in atmospheric particle processing. Secondary organic aerosols (SOA) are formed from gas-to-particle partitioning and chemical processing in the gas and particle phases; however model studies underestimate SOA mass and thus additional formation pathways must exist.

Results of studies presented show that chemistry induced by sunlight can play a major role in the formation and chemical evolution of atmospheric aerosol particles and aggregates in the sea surface micro-layer (SSM), thus building complexity in the environment. This presentation will discuss investigations of the fundamental processes that underlie atmospheric photochemistry, with an emphasis on the role of organic species at the water surface. The results presented describe studies of photochemical reactions of oxoacids at water-air interfaces to answer at a molecular level the following questions: What role does sunlight initiated chemistry play in processing organics in the atmosphere? In what way does oxygen affect these reactions and to what extent can we use bulk laboratory data to model realistic environmental aqueous atmospheric particles? How do photochemical reactions affect the interface of atmospheric aerosol by creating polymers and high-molecular weight compounds that then self assemble at the surface?

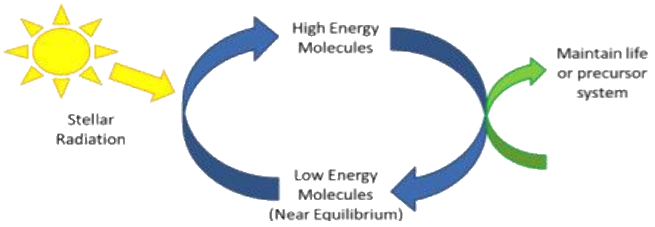

Figure 1. *Schematic of the transduction of energy by photochemistry to sustain metabolism.*

Reference

1) Rebecca J. Rapf, Veronica Vaida *Physical Chemistry Chemical Physics*, **18**, 20067-20084 (2016) DOI: 10.1039/C6CP00980H
2) Griffith, Elizabeth C., Rapf, Rebecca J., Shoemaker, Richard K., Carpenter, Barry K., Vaida, Veronica, *J. Am. Chem.* Soc. **136**(10), 3784-3787 (2014)