VISITING SCHOLAR PROGRAM

The PHI BETA KAPPA Society

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Public Lecture Offerings

So Much Water in the Atmosphere

Water is one of the most abundant resources in our atmosphere and, because of its ability to be both a hydrogen bond donor and acceptor, water can form very stable new chemical species, not considered in the chemistry of the atmosphere before. These new chemical entities can dramatically affect the chemistry in the atmosphere, including heterogeneous removal and alteration of the photochemical properties of the atmospheric species. It also provides fundamental new insight into chemistry on clouds that have never been imagined – turning clouds into mini-chemical reactors. This talk will review both experimental and theoretical investigations of water effects on gas phase reactions. A goal of the talk is to provide an understanding of the fundamental concepts underlying potential water effects, imparting a framework to better understand global effects of water chemistry in our atmosphere.

A Fresh Look at the Chemistry Behind Acid Rain

The two major components of acid rain are sulfuric acid (H_2SO_4) and nitric acid (HNO_3). Sulfur dioxide (SO_2) is the main precursor of H_2SO_4. Atmospheric sulfur dioxide is oxidized homogeneously by reaction of SO_2 with OH and O_2 leading to SO_3, which then reacts with water to form sulfuric acid. This is the now accepted acid rain mechanism for generation of atmospheric sulfuric acid. In this talk we will review the traditional acid rain mechanism and we will introduce a new acid rain mechanism that relies on the photochemistry of SO_2 and show how this new chemistry can be an important new ingredient in fully understanding how acid rain formation is formed, but not yet considered by current atmospheric models. Why is this important? Sulfur

dioxide has been proposed in solar geoengineering as a precursor of H_2SO_4 aerosol, a cooling agent active in the stratosphere to contrast climate change due to the anthropogenic emissions of greenhouse carbon dioxide. Considering the introduction of SO_2 in the stratosphere, the photochemistry of this new chemistry is critical to assessing whether if strategies to mitigate climate change is feasible by injection of SO_2.

Classroom Discussion Topics

1. Water, water everywhere: how does water connect the biosphere.
2. Before geoengineering, some fundamental chemistry: what are lessons learned.
3. Origin of global warming: fact or fiction – what is the science behind the phenomenon.