# KINETIC CONVERSION OF CO TO $CH_4$ IN THE SOLAR SYSTEM

Y. L. Yung*, M. Allen and J. P. Pinto
California Institute of Technology

Some of the most interesting chemistry in the Solar System involves changes in the oxidation state of the simple carbon species. The chemical pathways for the conversion of $CH_4$ to CO and $CO_2$ are for the most part known. The reverse process, the reduction of CO to $CH_4$, is, however, poorly understood. This is surprising in view of the importance of the reduction process in the chemistry of the Solar System. Recently we investigated the chemical kinetics of a hitherto unsuspected reaction. It is argued that the formation of the methoxy radical ($CH_3O$) from $H+H_2CO$ may play an essential role in the reduction of CO to $CH_4$. The rate coefficient for this reaction has been estimated using the approximate theory of J. Troe and transition state theory. We will discuss the implications of this reaction for the chemistry of CO on Jupiter, in the solar nebula, for interpreting the laboratory experiments of A. Bar-Nun and A. Shaviv and A. Bar-Nun and S. Chang and for organic synthesis in the prebiotic terrestrial atmosphere. The possible relation of CO reduction in the solar nebula and polyoxymethylene observed in comet Halley will be discussed.