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**FINAL REPORT FOR NATIONAL AERONAUTICS AND SPACE
ADMINISTRATION GRANT NAGW-254**

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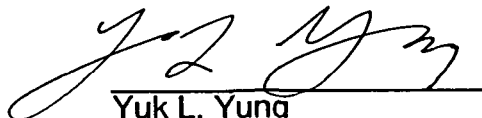
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(NASA-CR-183029) PHOTOCHEMICAL AND THERMAL MODELING IN THE EARLY ATMOSPHERE OF THE EARTH Final Report, 1 Oct. 1981 - 31 Dec. 1987 (California Inst. of Tech.)	3 p	N88-25093
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**PHOTOCHEMICAL AND THERMAL MODELING IN THE EARLY
ATMOSPHERE OF THE EARTH**
(formerly Photochemical Processes in the Primitive Atmosphere of the Earth)

Period of Research October 1, 1981 to December 31, 1987

NASA Technical Officer
John Rummel


Yuk L. Yung
Principal Investigator

FINAL TECHNICAL REPORT

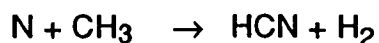
A number of research projects were completed under this proposal in the past fiscal year. They are briefly summarized as follows:

Estimation of the reaction rate for the formation of CH₃O from H + H₂CO: Implications for chemistry in the solar system.

The simplest carbon compounds, present in the terrestrial and planetary atmospheres, exhibit a wide range of oxidation states, carbon dioxide and methane being the most oxidized and the most reduced form of carbon, respectively. The question arises as to the origin of and the interconversion among the carbon species. The chemical pathways for the conversion of CH₄ to CO and CO₂ are for the part known. The reverse process, the reduction of CO to CH₄ is however, poorly understood. We propose a new reaction H₂CO + H + M → CH₃O + M, which might play a fundamental role in the reduction of CO to CH₄.

An update of nitrile photochemistry on Titan

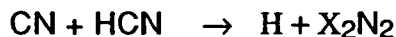
According to Yung *et al.* (1984), the primary source of nitrile compounds in the atmosphere of Titan is the reaction



where the nitrogen atoms are derived from electron impact dissociation of N₂,

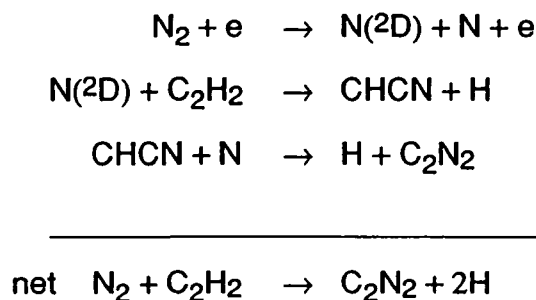


Cyanogen (C₂N₂) was thought to form via



and the authors showed that this reaction could account for the observed abundance of C₂N₂ (Kunde *et al.* (1981) if the rate coefficient, *k*, were as large as 3.1 x 10⁻¹¹cm³s⁻¹. Recent experiments by Li *et al.* (1984) suggested that *k* = 1.8 x 10⁻¹⁴cm³s⁻¹ at 300 K, which is considerably lower than the original estimate.

So a new scheme has to be explored to explain the Voyager observations. The postulated new scheme is as follows:



Publications

- Y.L. Yung. An Update of Nitrile Photochemistry on Titan. *Icarus* **72**, 468-472 (1987).
- Y.L. Yung, W.A. Drew, J.P. Pinto, and R.R. Friedl. Estimation of the Reaction Rate for the Formation of CH³O from H + H₂CO: Implications for Chemistry in the Solar System. *Icarus* **73**, 516-526 (1988).
- Y.L. Yung, R.R. Friedl, J.P. Pinto, K.D. Bayes, and J.-S. Wen. Kinetic Isotopic Fractionation and the Origin of HDO and CH³D in the Solar System. *Icarus* **74**, 121-132 (1988).