# Chemical Kinetics of Polycyclic Aromatic Hydrocarbons in The Solar Nebula


Monika Kress
*Department of Physics and Astronomy*
*San Jose State University*
*San Jose, California 95192*
*USA*
mkress@science.sjsu.edu

Michael Frenklach
*Department of Chemical Engineering*
*University of California*
*Berkeley, California*
*USA*

Alexander G.G.M. Tielens
*Kapteyn Astronomical Institute*
*University of Groningen*
*Groningen, The Netherlands*

Christopher P. McKay
*Space Science Division*
*NASA Ames Research Center*
*Moffett, Field, California 94035-1000*
*USA*



Polycyclic aromatic hydrocarbons (PAHs) are strongly-bound organic compounds that are abundant in interstellar space and in primitive meteorites. Of all interstellar organic compounds, they are the best candidate to survive (1) processing in the solar nebula and in meteorite parent-bodies and (2) delivery to the early Earth or other habitable planets. PAHs would have been important constituents in the early atmospheres of terrestrial planets, because these compounds readily absorb ultraviolet light and may play a role in particulate haze formation. PAHs are sometimes considered as biomarkers, so it is important to understand any nonbiological sources of these compounds.

Several outstanding questions in astrobiology address the relationship between PAHs observed in stellar outflows and in the interstellar medium and those found in meteorites. Are meteoritic PAHs inherited from carbon stars? Are these compounds modified in the solar nebula, and if so, where, how and when? Can the abundances and varieties of PAHs in chondrites give more insight into the evolution of the solar nebula and other planet-forming disks? To address these questions, we implement a computational combustion model for the chemical kinetics of PAH formation, growth and destruction within a parameter space of astrophysical timescales, pressures, temperatures, C/O ratios and other factors to address these questions. We find that, under the high $H_2/CO$ and O/C ratios and low pressure conditions of the solar nebula, PAHs are destroyed within nebular timescales at T > ~1000 K. The main route to destroy PAHs involves OH radicals, which derive from $H_2O$.