

Missing Pieces in Our Understanding of Astrochemistry: the Answers are in the Lab

Edwin Bergin and Gary J. Melnick
Harvard-Smithsonian Center for Astrophysics

During the past 2.5 years, NASA's Submillimeter Wave Astronomy Satellite (SWAS) has been conducting pointed observations toward over 100 molecular clouds and regions of ongoing star formation in the lines of several atoms and molecules, including gaseous water and molecular oxygen. It has become clear that the SWAS-inferred abundances of both H₂O and O₂ cannot be explained by simple gas-phase chemical models, particularly toward colder regions. Instead, a picture is emerging in which the effects of dust grains - both as sites of depletion and molecule formation - can have a profound influence on the composition of the gas and must be considered. This review will summarize the SWAS results to date, describe a new model that may explain these results and, finally, outline the laboratory data needed to support (or refute!) the assumptions underlying these models.

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