Turbulent Diffusion and Its Effects on the Chemical Composition of Cloud Cores

Taoling Xie[1], Mark A. Allen [1,2] and William D. Langer[1]

1 Jet Propulsion Laboratory, California Institute of Technology, Pasadena, CA 91109

2 Division of Geological and Planetary Sciences, California Institute of Technology, Pasadena, CA 91125

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ABSTRACT

'1 '111'1 ɔulence inIIɪolecular ("1011(1s is wellrecognized, but its resulta nt transport (:fl'eels 011 the chemicalstructur c of the clouds arc not widely appreciated. The chemicalcomp ositi on of the dense molecular clouds is important for determining the initial conditions of protostar formation. We present an invest igation of the turbulent diffusion and its effects on the chemical composition of dense ɪnolecular cores. We ɪnodel the time-dependent gas-phase chemistry in a der ɪse molecular cloud with turbul ent diffusion. The cloud has fixed density and ter ɪperature profiles, and i s subject to the interstellar radiation field. We estimate tl ɪe diffusion coefficient based on the observed tur bulence in ɪɪolecul ar clouds. We find tl ɪat turbulent diffusion leads to sig nificantly larger abundances of atomic carbon and some other carbon species, and smaller ab u ndances of' H_2O a n d O_2 for the "steady- st ate" chemist r y in t he dense core, in general ag reem ent wit h observations. We a l s o find that turbulent diffusion causes a ɪɪoderate enhan cement of the fractional ionization level in the dense, UV-shielded c o r e in our current chemical ɪɪodel.