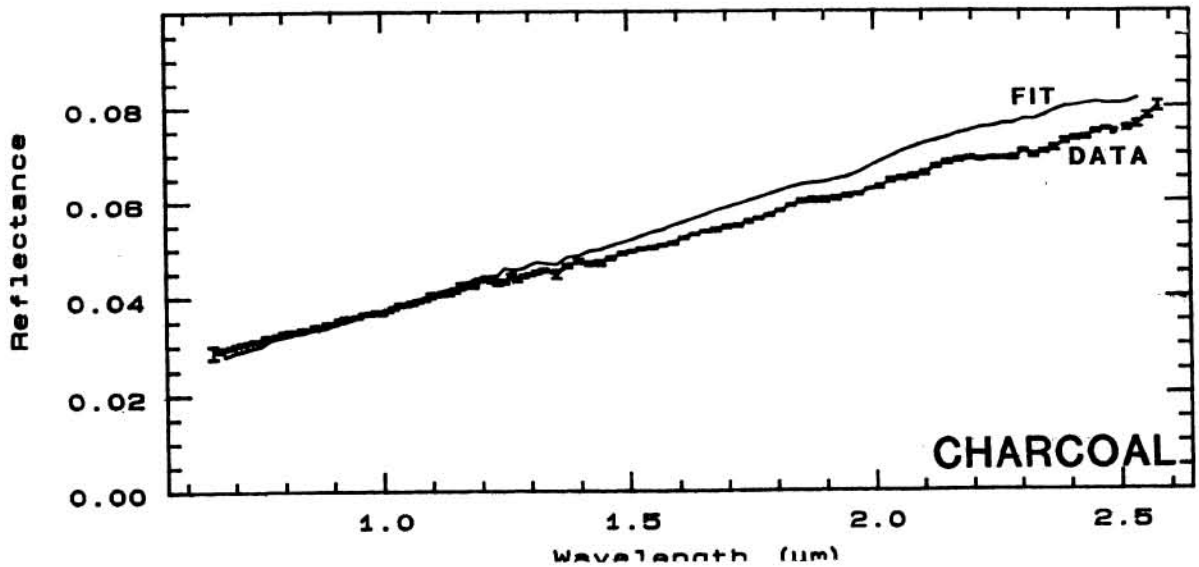
APPLICATION OF RADIATIVE TRANSFER THEORY TO THE SPECTRA OF MINERAL MIXTURES Marcia L. Nelson (Planetary Geosciences Division, Hawaii Institute of Geophysics, University of Hawaii, Honolulu, Hawaii 96822) and Roger N. Clark (Mail Stop 964, United States Geological Survey, Box 25046 Federal Center Denver, Colorado 80225)

This study examines the problems involved in computing the reflectance spectra of a mixture where the single scattering albedos and phase functions are very different. This is an extreme test of the validity of the radiative transfer theories in use and indicates the maximum error that might be encountered.

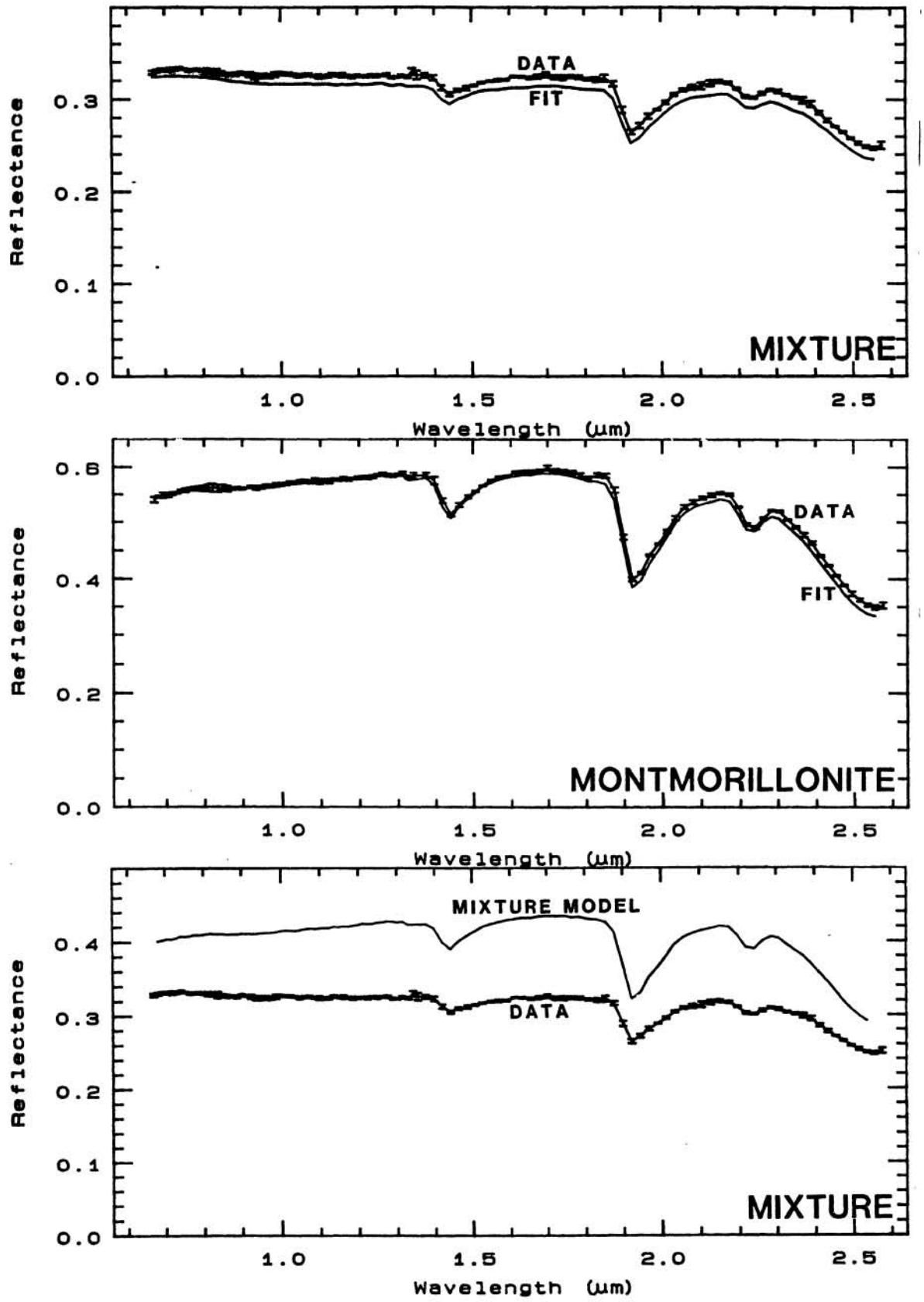
Infrared reflectance spectra of montmorillonite, charcoal, and an intimate mixture of 90% montmorillonite and 10% charcoal were measured at a variety of photometric geometries. The reflectance spectra for each sample were fit with the reflectance theory of Hapke (1981) to derive the single scattering albedo and the single particle phase function. Spectra calculated from the fit parameters matched the measured spectra well. The parameters derived from the fits to the montmorillonite and charcoal spectra were used to calculate the average single scattering albedo and single particle phase function. The average parameters were more similar to those derived from the fit to the montmorillonite spectra than those derived from the fit to the mixture spectra. Reflectance spectra calculated from the average parameters were higher than the measured mixture spectra. Therefore the effect of the charcoal was under estimated by the theory. Microscopic examination of the mixture sample showed small montmorillonite grains adhering to the large, irregular charcoal grains, which invalidated the assumption of random grain distribution on which the theory was derived. This may account for some of the discrepency, but it is probably not the only problem. Additional mixtures are being examined to determine whether similar discrepencies exist for other cases.

The results from this study show that the Hapke theory models the spectra of individual minerals at a variety of photometric geometries well, but it needs to be improved for mineral mixtures of components with extremely different albedos.

Bruce Hapke, Bidirectional reflectance spectroscopy. 1. Theory. *J. Geophys.Res.*, **86**, 3039-3054.



© Lunar and Planetary Institute • Provided by the NASA Astrophysics Data System



© Lunar and Planetary Institute • Provided by the NASA Astrophysics Data System