Draft version April 7, 2011
Preprint typeset using LaTeX style emulateapj v. 6/22/04

SPITZER IRS SPECTROSCOPY OF THE 10 MYR-OLD EF CHA DEBRIS DISK: EVIDENCE FOR PHYLLOSILICATE-RICH DUST IN THE TERRESTRIAL ZONE

Thayne Currie[1], Carey M. Lisse[2], Aurora Sicilia-Aguilar[3], George H. Rieke[4], Kate Y. L. Su[4]

Draft version April 7, 2011

ABSTRACT

We describe *Spitzer* IRS spectroscopic observations of the $\sim$ 10 Myr-old star, EF Cha. Compositional modeling of the spectra from 5 μm to 35 μm confirms that it is surrounded by a luminous debris disk with $L_D/L_\star \sim 10^{-3}$, containing dust with temperatures between 225 K and 430 K characteristic of the terrestrial zone. The EF Cha spectrum shows evidence for many solid-state features, unlike most cold, low-luminosity debris disks but like some other 10–20 Myr-old luminous, warm debris disks (e.g. HD 113766A). The EF Cha debris disk is unusually rich in a species or combination of species whose emissivities resemble that of finely-powdered, laboratory-measured phyllosilicate species (talc, saponite, and smectite), which are likely produced by aqueous alteration of primordial anhydrous rocky materials. The dust and, by inference, the parent bodies of the debris also contain abundant amorphous silicates and metal sulfides, and possibly water ice. The dust's total olivine to pyroxene ratio of $\sim$ 2 also provides evidence of aqueous alteration. The large mass volume of grains with sizes comparable to or below the radiation blow-out limit implies that planetesimals may be colliding at a rate high enough to yield the emitting dust but not so high as to devolatize the planetesimals via impact processing. Because phyllosilicates are produced by the interactions between anhydrous rock and warm, reactive water, EF Cha's disk is a likely signpost for water delivery to the terrestrial zone of a young planetary system.

Subject headings: astrochemistry,infrared:stars,planetary systems:formation, planetary systems: protoplanetary disks, radiation mechanisms:thermal, techniques:spectroscopic, stars: individual (EF Cha)