

expected observation rate of extrasolar large comets has recently been considered (McGlynn and Chapman 1989). We consider the expected flux of smaller particles. We use model size distributions for the ejected debris to calculate the expected flux to Earth of various sized particles. We find that the flux of extrasolar particles may be comparable to observed meteorite fluxes, if the standard solar system formation model is applicable to other planetary systems. The expected fluxes of extrasolar particles are comparable to the fluxes of impactors with extrasolar velocities reported by the Long Duration Exposure Facility (LDEF) (McDonnell 1991), and by the Kharkov radar (Stohl 1986). Also, a number of recovered meteorites may be extrasolar. Conversely, if it can be determined that no meteorites or small meteoroids are extrasolar planetary debris, then the standard solar system formation model will be constrained.

33.12

A Radial Velocity Search for Extra-Solar Planetary Systems

W. D. Cochran and A. P. Hatzes (U. Texas)

The McDonald Observatory Planetary Search (MOPS) is designed to detect Jupiter size planets in orbit around solar type stars by detecting variations in radial velocity of the primary star due to its orbit around the system center of mass. The MOPS survey started in September 1987 using telluric O₂ lines as a fiducial reference system. In the fall of 1990, we replaced this system with a stabilized I₂ gas absorption cell in order to improve radial velocity precision. With the I₂ cell we can achieve precision significantly better than 10 m s⁻¹. At this level we can detect a Jupiter-like planet around a solar-type star, and have some hope of detecting Saturn-like planets. The detectability of planets is ultimately limited by stellar pulsation modes and photospheric motions. Monthly MOPS observing runs on the McDonald 2.7 m telescope allow us to obtain at least 5 independent observations per year of the 33 solar-type (F5-K7) dwarfs on our observing list. We will present several examples of the MOPS results to date.

33.13

A Search for Young "Superplanets"

S. A. Larios, G. H. Gavankar (JHU), R. A. Brown, C. J. Burrows, D. K. Duncan, A. Nota, D. R. Soderblom, H. A. Weaver (ST ScI), D. W. Latham (CfA)

A "superplanet" is a stellar companion of mass $\geq 2 M_J$ that formed by accretion in a circumstellar disk (as planets do) rather than by collapse (as stars and brown dwarfs do). In the case of sufficiently young ($\leq 2-3 \times 10^5$ yrs) superplanets, advanced near-infrared imaging systems and techniques that have recently become available should soon detect such objects around nearby stars—if they exist.

We have begun a search for superplanets around a sample of about thirty nearby G and M dwarfs, which we have selected for indications of youth. Using the ProtoCam camera on the IRTF, we have obtained a few hundred short-exposure images of a subset of our sample at K- and L'-band. Since a compatible coronagraph was not available at the time of the observations, we took images with and without a simple focal plane occulting mask.

We have analyzed our initial set of images by removing best-fits to the star signal, stacking, smoothing, and then examining the residual data for plausible point-source signatures. Limiting magnitudes versus radial distance from the star have been determined by introducing random false companions and estimating the probability of their detection. We will discuss the portion of planetary "discovery space" our search program explores.

33.14-P

Astrophysical Constraints on Planetary Environments

L. Doyle (SETI Inst.), C. McKay and R. Reynolds (NASA/Ames), D. Whitmire and J. Matrese (U. S. Louisiana), W. Davis (SETI Inst.)

The targeted SETI (Search for Extraterrestrial Intelligence) project requires specification of target stars likely to have evolved intelligent biological forms. This requires an in depth examination of the evolution of the solar system's ecoshell or habitable zone (HZ), for application to other stellar systems. Slight variations in stellar evolution models result in significant modifications of the solar system's ecoshell, and we discuss this in light of the new limits defining the HZ (outer - condensation temperature of CO₂, inner - moist runaway greenhouse effect). These boundaries to the classical HZ can then be extended to defining possible planetary environments around the ubiquitous M and K dwarf stars (previously considered unlikely candidates for SETI) as well as the abundant binary systems in the stellar neighborhood, examining how planetary atmospheres may be able to mitigate the likely effects on exobiology of these more unusual environments.

33.15-P

Cometary Diagnostics of Solar Nebula Chemistry

S. Wyckoff, M. Womack, L. Ziurys (Ariz. St. Univ.)

The isotopic, elemental and molecular abundances observed in comets contain important information about the prevailing conditions and chemical processing in the outermost parts of the early solar nebula. Ammonia abundances have been inferred from NH₂ production rates derived in a small sample of comets. The N₂/NH₃ ratio has been estimated for comet Halley. An inventory of nitrogen compounds in comet Halley indicates a large depletion of elemental nitrogen in the cometary volatiles, and that most of the nitrogen is carried by NH₂ and CN containing compounds. The nitrogen deficiency can probably be explained by fractionation during condensation of volatiles in the outer solar nebula or by subsequent thermal diffusion as the comet nucleus orbits the sun, or both. The N₂/NH₃ ratio in Halley is compared with the same ratio in dense molecular clouds. We find that N₂ $\sim$ NH₃ in both the early solar nebula and the present-day star-forming regions.

Session 34: Late Papers

(D. Cruikshank, Moderator)

3:30-5:00, Small Conference Room

34.01-L

POLARIS II, a Polarimetric Imaging Spectrometer.

J. T. Bergstralh (JPL/Caltech), D. Glenar, R. Zimmerman, B. Saif (NASA/GSFC), W. H. Smith (Wash. Univ., St. Louis)

Acousto-Optic Tunable Filters (AOTFs) are compact, rugged optical devices that offer effectively continuous wavelength selection over tuning ranges in excess of an octave. AOTFs can be designed to operate efficiently anywhere between 0.4 and about 5 microns, their bandpasses can be tailored to suit measurement objectives, and they have no moving parts. As a built-in bonus, AOTFs offer, at any selected wavelength, simultaneous imaging in two orthogonal polarizations. Consequently, they ought to be attractive candidates as elements of versatile new optical remote-sensing instruments. Regrettably, however, AOTFs are not widely known in the planetary science community: only a few practical field applications have been reported in the unclassified literature (e.g. Smith et al., 1987), so it is difficult to justify experiments that incorporate them. This poster paper describes the design, construction and initial field-testing of a proof-of-concept