JPL SURP Strategic Topic Areas - 2007

Topic Area:	3. Characterizing Exoplanets Where Life Could Exist
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The field of extrasolar planets is among the most dynamic in astrophysics and is a topic of strategic interest to NASA. More than 200 extrasolar planets are known and ongoing search programs are increasing this number rapidly. The characterization of extrasolar planets, through measurements of their emitted light, is a relatively recent accomplishment. Most of these measurements have been made with the Spitzer Space Telescope although at least one ground based detection has been published and active ground based efforts are underway by teams in both the US and Europe. This grand challenge activity will materially contribute to the detailed study of Earth-like planets in the future (20 years hence) and will assist NASA in accomplishing it's long-term goal of studying worlds around other stars where life could exist.

Objective: This topical area is intended to support observational work to characterize exoplanet systems and any development needed to enable or improve the characterization. *The goal is exoplanet characterization with a measurement dynamic range (with respect to the stellar primary) of at least 1000:1 in three years and at least 10,000:1 in 5 years*. In addition to other factors, proposals will be judged on the expected signal-to-noise ratio on intended exoplanet targets. Thus, proposals for observations in the optical will need to achieve considerably higher dynamic range than proposals for observations in the infrared. In any case, ***proposals are expected to contain a significant observational component with the objective of obtaining unique, high-impact science, measurements that characterize one or more exoplanets***. At a given wavelength, spectral measurements will be valued over broad-band measurements. However, it may be that in some bands, the field is not sufficiently advanced to support spectral measurements. While there is no wavelength specification for the proposal, wavelengths between 0.4 – 14 microns are considered especially scientifically useful; proposals for wavelengths outside of this band should explain the scientific utility of the measurements.

While technology is not the primary focus, it is expected that that the characterization of exoplanets will require new approaches which could include new techniques, calibration, instrumentation, and algorithms. Infrastructure upgrades for existing facilities are also permissible *if they constitute an essential enabling factor* in obtaining the exoplanet observations. Proposals may consider obtaining data form space, ground, or air-born telescopes. Although a proposal may rely on a mixture of techniques, calibration, instrumentation, and algorithms to achieve unique exoplanet measurements, these topical areas are discussed below as if they were the focus of a proposal. ***It is expected that successful proposals will articulate clearly how new exoplanet measurements will be accomplished during the proposed work.*** Proposal evaluation will include looking for evidence of adequate "sky time", for characterization of systematics and validating the method, early in the proposed work. The spirit of this proposal call is "get the results, we don't care how you do it."

Techniques: refers to the basic method for separating the stellar and planet light. Examples of techniques suitable for exoplanet characterization include the secondary eclipse method, closure phase, chronography, nulling, etc. Development of both existing techniques and new techniques for exoplanet characterization is supportable under this topic. There is no preferred technique for this proposal call.

Calibration: refers to the method determining the instrument response function. Although the details will depend on the technique, high dynamic range measurements require calibration that is different from more routine measurements. We anticipate that well established techniques could benefit from new calibration approaches. New techniques may also need calibration approaches.

Instrumentation: refers to the hardware necessary to execute the technique or calibration. While there is no explicit restriction on hardware expenses, the level of funding will not support major projects (such as a facility class, extreme AO system for an 8-m class telescope).

Algorithm: refers to an implementation of the technique or calibration. Some examples of supportable effort could include algorithms for either data processing or improvements in real-time control. If the algorithm can (1) improve the characterization of exoplanets, and (2) be demonstrated with exoplanet measurements, it is eligible to be considered for support under this proposal call.