279.12 — ChoosingOptimal Filters for Photometric Redshifts

A. Connolly[1]; *J. Kalmbach*[1]; *J. Vanderplas*[2]
[1] *Astronomy, University of Washington, Seattle, WA*
[2] *Google, Seattle, WA*

We apply ideas from information theory to create a method for the design of optimal filters for photometric redshift estimation. We show the method applied to a series of simple example filters in order to motivate an intuition for how photometric redshift estimators respond to the properties of photometric passbands. Then design a realistic set of six filters covering optical wavelengths that optimize photometric redshifts for z < 2.3 (comparable to the Large Synoptic Survey Telescope, LSST, survey parameters). From a simulated catalog of these optimal filters we show that we can improve the standard deviation of the photometric redshift uncertainty by 7.1% overall and reduce outliers by 9.9% over that achieved with the LSST filters. We show how this approach can be applied to the general case of optimizing filter design for a range of astronomical problems.

279.14 — HII Galaxies: Feasibility as Cosmic Distance Indicators

A. Smith[1]; *G. Corujo*[2]; *K. Chanchaiworawit*[3]; *R. Guzman*[2]; *Galaxy Origins and Young Assembly (GOYA)*[1]
[1] *Eastside High School, Gainesville, FL*
[2] *Department of Astronomy, University of Florida, Gainesville, FL*
[3] *Department of Physics, Florida Atlantic University, Boca Raton, FL*

HII galaxies are a subset of blue, compact dwarf galaxies with an overwhelming star formation rate, making them exhibit strong emission features similar to those of HII regions. Their Balmer emission lines such as H-Beta show an empirical relation between its luminosity and velocity dispersion. This L-sigma relation can be used as a distance indicator. With their plentifulness and relatively strong emission features, HII galaxies can be reliable cosmic probes. However, second parameters such as metallicity, age of the stellar population, and underlying kinematics play an important role in the scatter of this L-sigma relation as well. In this work, we present the preliminary results of the Integrated-Field Unit observation Spectroscopy in the optical band of four (4) low redshift (low-z) HII galaxies (i.e. NVSS-J153412+571655, HS-1402+3650, LEDA-101538, and LEDA-3090963) using MEGARA at the Gran Telescopio Canarias (GTC). The observations reveal the spatial distribution of these second parameters, especially weak velocity fields. These second parameters, if not taken into account, can broaden the scatter and skew L-sigma relation. Thus, the study will provide a benchmark sample, necessary to utilize high redshift HII galaxies as cosmic distance indicators in constraining cosmological parameters.

279.15 — Correlations in the orientations of galaxies from the Sloan Digital Sky Survey

D. Falcone[1]; *E. Bunn*
[1] *Physics Department, University of Richmond, Richmond, VA*

The goal of this research is to use galaxy data taken from the Sloan Digital Sky Survey (SDSS) to create a better understanding of the possible correlations between galaxy orientations and the scales at which these correlations could exist. SDSS has compiled a database consisting of millions of galaxies with comprehensive information about the properties of each these galaxies; in particular, the position angle of each galaxy's major axis can be estimated from the data. We examine the two-point correlation function of these galaxy orientations.The expected result of this analysis is that, due to gravitational torques, at close distances a correlation in shape and orientation will exist amongst galaxies but these correlations will decrease rapidly with distance. Correlations are also expected due to gravitational lensing. While the former should be significant only for galaxies that are physically close, the latter should be visible for galaxies that addition, we are interested in testing exotic cosmological models in which global isotropy is violated, which could lead to orientation correlations that persist over larger scales.We have developed methods for computing two- and three-dimensional correlation functions and applied them to samples of spiral and elliptical galaxies from SDSS. We will present preliminary results of this analysis.

279.17 — Density and Velocity Profiles for Large-scale Cosmological Filaments

T. Viscardi[1]; *L. Graham*[1]; *B. Young*[1]; *M. Crone-Odekon*[1]; *E. Halstead*[1]; *M. Jones*[2]; *APPSS Team*[1]; *Undergraduate ALFALFA Team*[1]; *ALFALFA Team*[1]
[1] *Skidmore College, Saratoga Springs, NY*
[2] *Instituto de Astrofísica de Andalucía, Andalucía, Spain*

In preparation for comparison with the Arecibo Pisces-Perseus Supercluster Survey (APPSS), we present the theoretically expected density and velocity profiles for large-scale ($\sim$ 50 Mpc) filaments from the Millennium simulation. We use an observationally-friendly method to identify filaments using the positions of large groups of galaxies, and average filaments together to find the typical structure of a filament in terms of cylindrical density profile and velocity infall profile. Both profiles can be fit by simple functions, but show a large scatter across the population of filaments. We are in the process of categorizing filaments to facilitate comparison with observations of specific filaments, like the Pisces-Perseus Supercluster filament. This work has been supported by NSF grant AST-1637339.

Poster Session 280 — Extrasolar Planets: Direct Imaging

280.01 — Dynamically Scheduling Direct Imaging Missions

C. Spohn[1]*; D. Savransky*
[1] *Mechanical and Aerospace Engineering, Cornell Universtiy, Ithaca, NY*

Direct imaging missions being planned currently, like HabEx and LUVOIR, utilize a partially dynamic mission schedule. In the first half of the mission they make a series of predetermined observations and revisit promising targets in the second half. However, this kind of mission schedule risks missing the optimal times to revisit promising target stars when the optimal times fall in the first half of the mission. Here, we show a method for a fully dynamic mission schedule. To do this we simulate a cloud of planets around a star and identify which planets in the cloud would be detectable to the telescope. Then with a maximization procedure, we calculate both the optimal time to revisit the star and the science yield at that time, using the detectable planets in the simulation and whether a detection was made by the mission. We show mission simulation results comparing the approaches and demonstrate that when implemented, this process allows a mission to focus on the most beneficial target stars and provides information on observed exoplanets, such as better bounds for orbital parameters, that a more static mission plan cannot.

280.02 — The Gemini Planet Imager Exoplanet Survey: Giant Planet and Brown Dwarf Demographics from 10-100 AU

E. L. Nielsen[1]*; R. De Rosa*[1]*; B. Macintosh*[1]*; J. Wang*[2]*; J. Ruffio*[2]*; E. Chiang*[3]*; M. Marley*[4]*; D. Saumon*[5]*; D. Savransky*[6]*; The Gemini Planet Imager Exoplanet Survey Team*[1]
[1] *KIPAC/Stanford, Stanford, CA*
[2] *Caltech, Pasadena, CA*
[3] *UC Berkeley, Berkeley, CA*
[4] *NASA/Ames, Mountain View, CA*
[5] *Los Alamos National Lab, Los Alamos, NM*
[6] *Cornell University, Ithaca, NY*

The Gemini Planet Imager Exoplanet Survey (GPIES) has observed 521 young, nearby stars, making it one of the largest, deepest direct imaging surveys for giant planets ever conducted. With detections of six planets and four brown dwarfs, including the new discoveries of 51 Eridani b and HR 2562 B, GPIES also has a significantly higher planet detection rate than any published imaging survey. Our analysis of the uniform sample of the first 300 stars reveals new properties of giant planets (>2 M_{Jup}) from 3-100 AU. We find at >3 sigma confidence that these planets are more common around high-mass stars (>1.5 solar masses) than lower-mass stars. We also present evidence that giant planets and brown dwarfs obey different mass functions and semi-major axis distributions. Our direct imaging data imply that the giant planet occurrence rate declines with semi-major axis beyond 10 AU, a trend opposite to that found by radial velocity surveys inside of 10 AU; taken together, the giant planet occurrence rate appears to peak at 3-10 AU. All of these trends point to wide-separation giant planets forming by core/pebble accretion, and brown dwarfs forming by gravitational instability.

280.03 — Exoplanet classification probabilities from initial detections in a direct imaging mission

D. R. Keithly[1]
[1] *Mechanical and Aerospace Engineering, Cornell University, Ithaca, NY*

Large-scale future exoplanet direct-imaging missions like HabEx and LUVOIR are capable of detecting many new worlds around other stars. These detections result in planet-star separations and photon flux ratios, but these exoplanet observations could belong to a large sub-population of planets. We determine the probability that observed states from a single image belong to a specific planet sub-population of the overall planet-population. We assume extrapolated SAG13 as our overall planet-population, planet radius vs stellar flux at the planet for classifying planet sub-populations, and single-visit completeness to determine the probability a planet belongs to a specific sub-population of planets. This work presents a new metric for evaluating star-revisits in future telescope direct-imaging