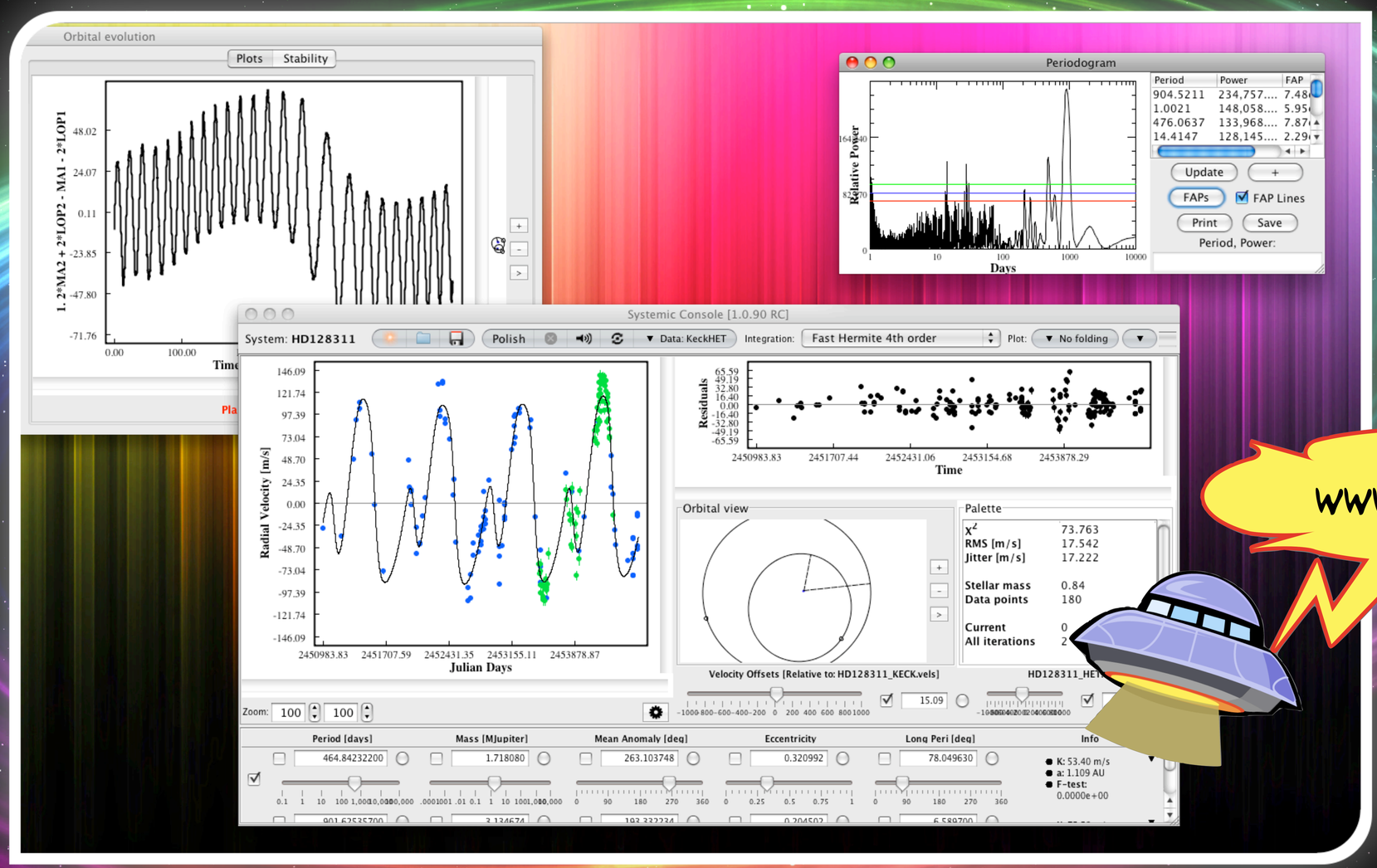
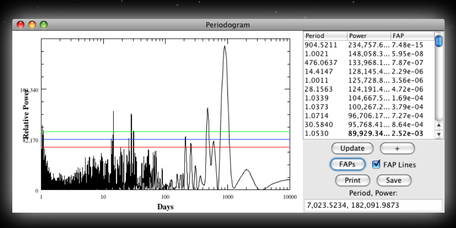
The Systemic Console

Stefano Meschiari, UCSC

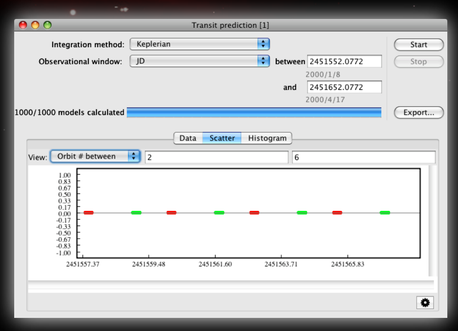


www.oklo.org

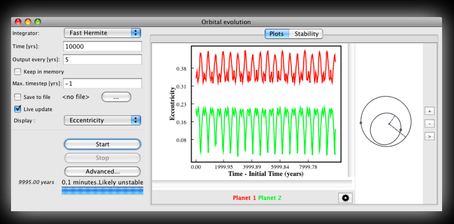
Screenshot of the main Console window, showing the HD128311 dataset, power spectrum and time evolution of resonant argument $\Theta_1 = 2\lambda_2 - \lambda_1 - \varpi_2$.



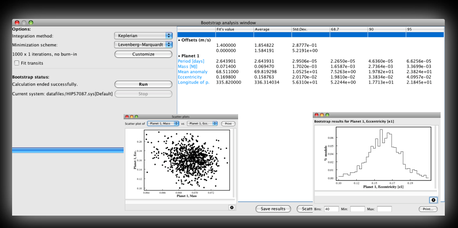
Lomb-Scargle periodograms & FAPs estimation



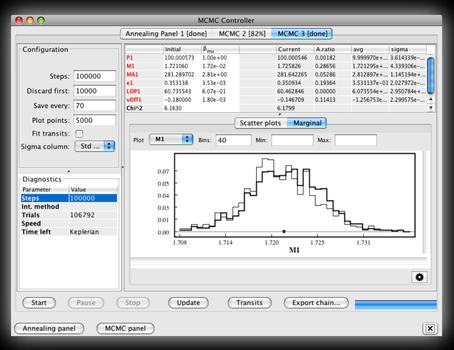
Dynamical transit prediction & fitting



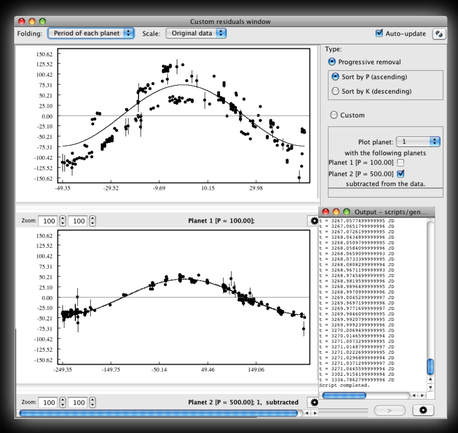
Newtonian fitting (RVs and transits); dynamical evolution



Bootstrap



MCMC error estimation & Simulated Annealing



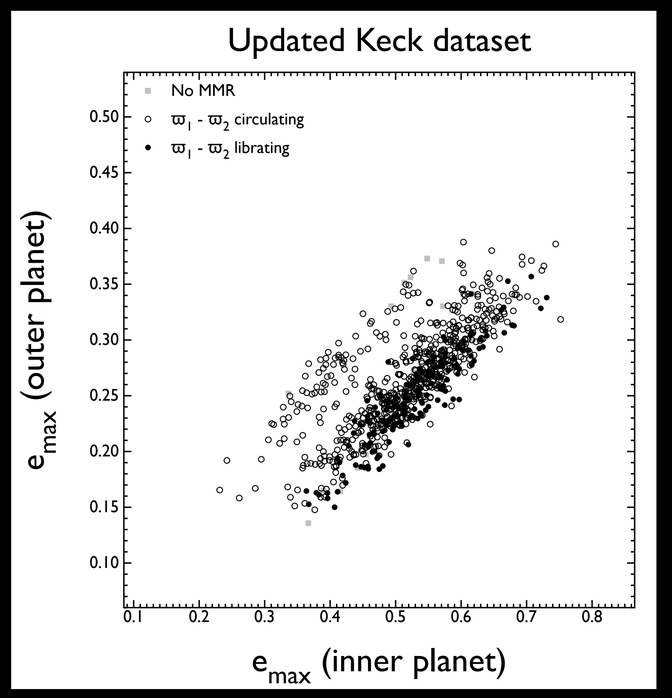
Parallelized Monte-Carlo simulations

INTRODUCTION

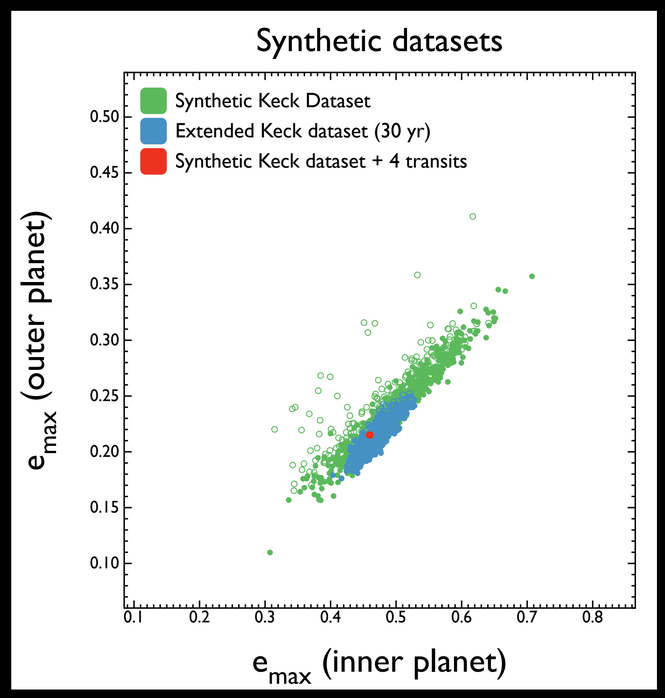
We present the Systemic Console, a new all-in-one package for the analysis and combined multiparameter fitting of Doppler radial velocity (RV) and transit timing observations.

RESONANCE CHARACTERIZATION OF HD128311

To showcase the package, we do a Monte-Carlo analysis of an updated Keck radial velocity data set for the HD128311 planetary system. HD128311 harbors a pair of planets that appear to be participating in a 2:1 mean motion resonance, which ensures the long-term stability of the system. The dynamical configuration, and in particular whether the system is apsidally corotating (ϖ_2 - ϖ_1 librating) can provide clues regarding the dynamical history and the capture into resonance.



RVs alone cannot fully determine the dynamical configuration [~75% circulating, 25% librating].



A small number of transits, if detected, completely characterizes the system.

We plot the maximum eccentricity attained by the two planets within 10,000 years for a bootstrap-generated set of 800 stable systems, and classify each based on the resonant arguments. Using synthetic datasets we verify that if a small number of primary transit midpoints is detected, then an immediate characterization of the system is achieved.

Meschiari, Wolf, Rivera, Laughlin, Vogt & Butler 2009, PASP, submitted