A DEEP SEARCH FOR SMALL PLANETS AND MULTIPLE SYSTEMS USING THE SARS PIPELINE

Aviv Ofir
Weizmann Institute of Science

The Kepler extended mission is tightly focused on measuring Eta-Earth - the frequency of terrestrial planets in the habitable zone of solar-like stars - as accurately as possible. Measuring Eta-Earth using Kepler requires being able to detect shallow and long-period transit signals. We propose to apply the SARS (Simultaneous Additive and Relative Sysrem) pipeline to accomplishing this goal. The SARS pipeline was already used to find >80 planet candidates in Kepler's data, all of which in multiple systems. Experience shows that this pipeline can allow detecting new planetary candidates which are typically shallower than the ones detected by the nominal Kepler pipeline, and with no period bias, making it well suited to improving the measurement of Eta-Earth. Moreover, the SARS pipeline has a well-defined evolution program that will improve it significantly: it is now already dramatically faster to compute and is expected to be about twice as sensitive to long-period signals in the near future. We propose to use these sensitive tools not just to look for Earth-like planets, but we also investigate multiplicity in planetary systems - cases where there are more than one planet and/or more than one star in the system. Such studies allow placing powerful constraints on theoretical models of star- and planet- formation. We present the array of innovative techniques developed to attack this problem, improving the detection limit for both single- and multiple- planet systems and spanning every stage of the pipeline: from data detrending, through data decorrelation, to signal detection and global modeling. We demonstrate that the techniques above compare well with the state of the art, and we also present the multiple achievements so far of using these techniques on Kepler data.