Proposal Title: **A K2 transiting planet search around bright M stars in the era of Gaia**
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We propose to use K2 in long-cadence mode to monitor photometrically 47 bright (K_p < 13.5) M0-M5 dwarfs in the field of observing campaign 1, following our initial proposal for the engineering campaign 0. The sample is partly under monitoring by the APACHE ground-based transiting planet search survey (Sozzetti et al. 2013). The stars have been selected from two source catalogues accurately devised to represent an almost complete collection of nearby, bright M dwarfs (Lépine et al. 2011, Frith et al. 2013). This selection thus ensures a reliable spectral classification of the proposed stars. For the subsequent fields we will submit similarly sized numbers of objects.

The scientific motivation of our proposal is threefold. First, bright M dwarfs represent one of the most valuable opportunity to search for possibly habitable planets, especially taking into consideration the K2 83-days campaign concept. Planets in the habitable zone of early to mid-M dwarfs are expected to have orbital periods of the order of up to several weeks, thus allowing for multiple transits to be observed by K2 during Campaign 0. With an estimated 0.1 mmag precision at 12^{th} mag in the Kepler bandpass, K2 will be uniformly sensitive to 1.5-2 Earth-radius planets around the sample, nicely complementing the APACHE survey sensitivity to 2-4 Earth-radii planets. Based on the Dressing & Charbonneau (2013) results, we expect ~1 transiting planet to be uncovered by K2 in this regime of radii.

Secondly, the high-precision photometry of K2 will allow to characterize the variability properties of the targets improving our knowledge on the activity levels of M dwarfs, in particular by determining the rotational periods through the evidence of stellar spots induced rotational modulation. Our proposed M dwarf targets are bright compared to those originally observed by Kepler (the median V mag of the sample is 12.6 mag, 4 mag brighter than Kepler-45). The high-precision spectroscopic observations to be carried out in case of transit detections, that upon confirmation enable the measurement of the mass of the companion and the characterization of the bulk density of the planet, will thus be not nearly as time consuming, and the K2 photometry combined with the analysis of spectroscopic activity indicators will allow to carefully calibrate any effects on radial-velocity measurements induced by stellar activity. Spectroscopic confirmation observations could effectively be conducted with the ultra-stable, high-precision HARPS-N spectrograph. The instrument, that recently was instrumental in determining the mass of an Earth-sized planet with and Earth-like density (Pepe et al. 2013), is presently utilized to carry out the large observing programme Global Architecture of Planetary Systems (GAPS, A. Sozzetti PI). One of the GAPS program elements focuses on the monitoring of the radial velocity variations of more than 100 M dwarfs included in the APACHE survey, aiming at detecting and characterizing Neptune-type and terrestrial-type planets on close-in orbits. The campaign 1 field location will allow for combined monitoring with HARPS-S.

Finally, the proposed target sample is of particular interest because it will be intensively observed by the Gaia satellite, successfully launched in December 2013. The distribution of the expected end-of-mission Gaia observations for this sample has a median of ~90 transits. The typical target brightness will ensure that Gaia will deliver its highest astrometric precision for this sample, thus allowing the determination of the distance to any detected planetary systems with accuracies of <<1%. The fundamental stellar parameters mass and radius will be determined with unprecedented precision by comparison with stellar evolution models and this, in turn, will allow to provide much improved determinations of the bulk properties of the detected planets. The stars being nearby (typically within 50 pc), Gaia astrometry will also allow to screen to outer regions for giant planetary companions, thus improving further the characterization of the architecture of any planetary system that might have been found.