RR Lyrae stars in the inner bulge: where the eagles dare

Members and roles:

Giuseppe Bono (coordination of the project, science analysis)

Massimo Dall'Ora (contact, analysis of the light curves and distance estimates)

Michele Fabrizio (cross-match of the catalogues)

Giuliana Fiorentino (science analysis)

Davide Magurno (analysis of the light curves and distance estimates)

Silvia Marinoni (cross-match of the catalogues)

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Associated Members:

Eva Grebel, Laura Inno, Bertrand Lemasle, Hans Walter Rix, Manuela Zoccali

Goals:

We propose to observe some selected fields of the inner Galactic bulge, to identify a sizable sample of old population tracers: the RR Lyrae (RRL) stars. These are excellent distance indicators, since they follow well-defined NIR (i and redward bands) Period-Luminosity relations, thus providing individual distances with an accuracy better than 5%. Moreover, they also follow reddening-free period-Wesenheit functions, of great interest in environments affected by strong and/or differential reddening. With these tools, we can measure the density profile of the old population, the 3D shape of the bulge and of the bar, and get fundamental observables to constrain the Milky Way formation models.

The proposed surveyed area is partially overlapping with OGLE-IV and extends to the very central regions of the bulge, where only near-infrared bands (izY) can be effective. Indeed, the absorption in the selected regions is strong but feasible between ≈3 mag (Y-band) and ≈6 mag (i-band). Moreover, the crowding is severe. Thus, to accomplish our goals, we need a wide field of view, the possibility to collect well-suited time-series data, a large collecting area together with a good pixel scale and performing optics. LSST is the only facility that will meet all these requirements.

The expected apparent i-band magnitude of the RR Lyrae stars is bright enough (i ≈22 mag) to allow us to propose this project as a normal Mini-Survey Project.

Immediate objectives of our project are:

1- catalogue of the observed RRL stars: characterization of the newly discovered RRLs, and cross-match with the already known (OGLE-IV);

2- individual distances of the RRL stars: 3D model and density profile of the old population of the bulge in the selected sight

3- comparison with the results from other stellar population tracers (red clump stars, etc.), an comparison with the theoretical models of the bulge formation

Milestones and Deliverables of the TF project:

1. Identify the fields that best trace the 3D shape of the bulge and of the bar (pseudo-bulge vs. classical bulge);
2. Identify possible overlaps of the selected fields with the DECam Bulge Survey, in order to cross-check the photometric calibrations and identifications of RRL stars;
3. Definition of the observational details: cadence, S/N range of the reachable RRL at different exposure times;
4. Coordination with other groups interested.

We stress that a companion project is carrying within the Stellar Variability in Crowded Fields Task Force, where we plan to analyse already available DECam data of the bulge, to understand the best analysis strategy of the data, and to compare the obtained pulsation parameters of the RRL with those available in OGLE-IV.

Timing of the TF project

Start on March 12th to June 15th, according to a following Gantt chart.