PRESS RELEASE

Released on 24 October 2012

A 84-million star color-magnitude diagram of the Milky Way bulge

Based on the article "Milky Way demographics with the VVV survey I. The 84-million star colour-magnitude diagram of the Galactic bulge", by Saito et al.

Published in *Astronomy & Astrophysics*, 2012, vol. 544, A147
This press release is issued in collaboration with the European Southern Observatory.

***Astronomy & Astrophysics* published the first analysis of a catalog of 84 million individual stars in the Milky Way bulge as a part of the VVV ESO public survey. This gigantic data set allows building the largest, deepest, and most accurate color-magnitude diagram ever produced, containing more than ten times more stars than any previous study.**

The bulge of the Milky Way is a large central concentration of ancient stars that is predominantly observed from the southern hemisphere. Understanding the formation and evolution of the bulge is fundamental for deciphering the properties of our Galaxy. In the bulge of the Milky Way, very faint individual stars can be observed, allowing astronomers to separate stellar populations based on age, kinematics, and chemical composition. However, the bulge is centered on the stellar disk of the Milky Way, where most of the stars, gas, and dust of our Galaxy is concentrated. This makes observations of the bulge very challenging because they are affected by crowding, extinction by interstellar dust, and the depth effect of stars being at a range of distances from us.

The VVV survey [1] is an ESO public survey conducted with the Visible and Infrared Survey Telescope for Astronomy (VISTA), located at the Paranal Observatory in Chile. VISTA is a 4.1-meter telescope performing surveys of the southern sky at near-infrared wavelengths. The VVV survey is dedicated to scanning the southern plane and bulge of our Milky Way in five near-infrared colors. Infrared wavelengths are less affected by extinction compared to visible ones, hence allowing the VVV survey to scan the heart of the Galaxy, where surveys in the visible range are limited by dust and gas. In addition, a four-meter class telescope such as VISTA yields much deeper observations than previous near-infrared surveys conducted with smaller telescopes.

In the paper published in *Astronomy & Astrophysics*, the team led by Chilean astronomers Roberto Saito and Dante Minniti and their colleagues [2] presents the analysis of a multi-color photometric catalog of the central concentration of stars in the bulge. This catalog consists of 84 million stars observed in three filters that covers 315 square degrees on the sky. Many individual catalogs generated by the VISTA calibration pipeline at the Cambridge Astronomical Survey Unit (CASU) were combined to produce this catalog. This enormous data set of individual stars has yielded the largest, deepest, and most accurate color-magnitude diagram ever produced for the bulge.

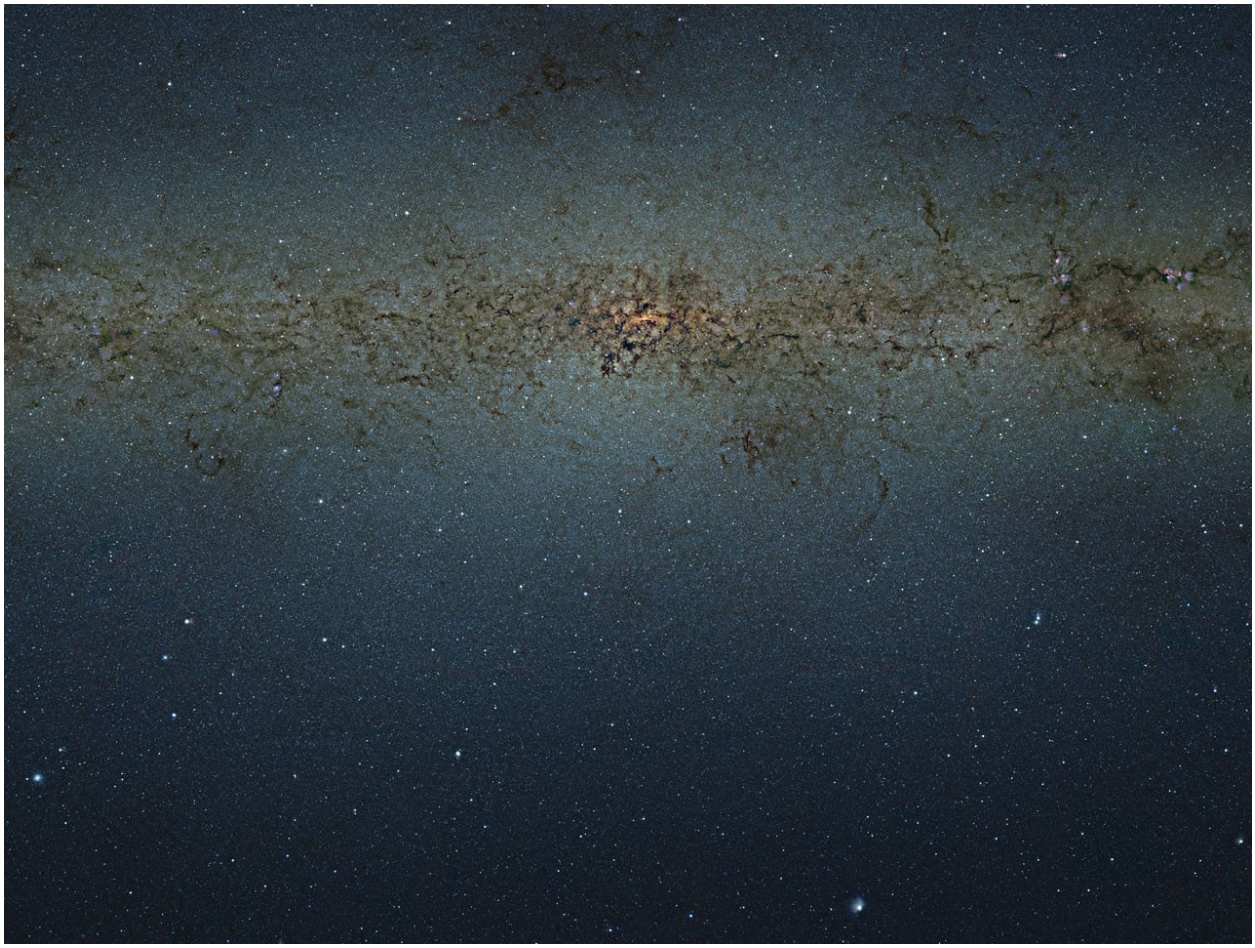

Fig. 1. VISTA gigapixel mosaic of the central parts of the Milky Way. A zoomable version of this picture is available on the ESO web site. *Credit: ESO/VVV Consortium, Acknowledgement: Ignacio Toledo.*

A color-magnitude diagram is a graph of the apparent brightness of an object vs. its color (its relative brightness in two different filters). These observed quantities can be related through models to stellar luminosity, temperature, mass, composition, and the amount of foreground dust. Each star occupies a single position in the diagram at any moment during its lifetime and, since we see the ensemble as a snapshot of the population (where each star has different mass and age), it is a census of the stellar component of the Galaxy. The diagram Saito and colleagues present in their paper registers the fingerprint of the structure and content of the Galaxy. For instance, one feature is the signature of the X-shape (or peanut shape) of the bulge. Another feature of the diagram reveals a significant population of red dwarf stars, which are valuable targets for searching low-mass extrasolar planets.

The VVV observations cover more than 500 square degrees of the Galactic bulge and plane using five filters. There is a related, not yet completed study that spans five years and searches for variable objects (such as pulsating stars, interacting binary systems, starspots) using one of the infrared filters.

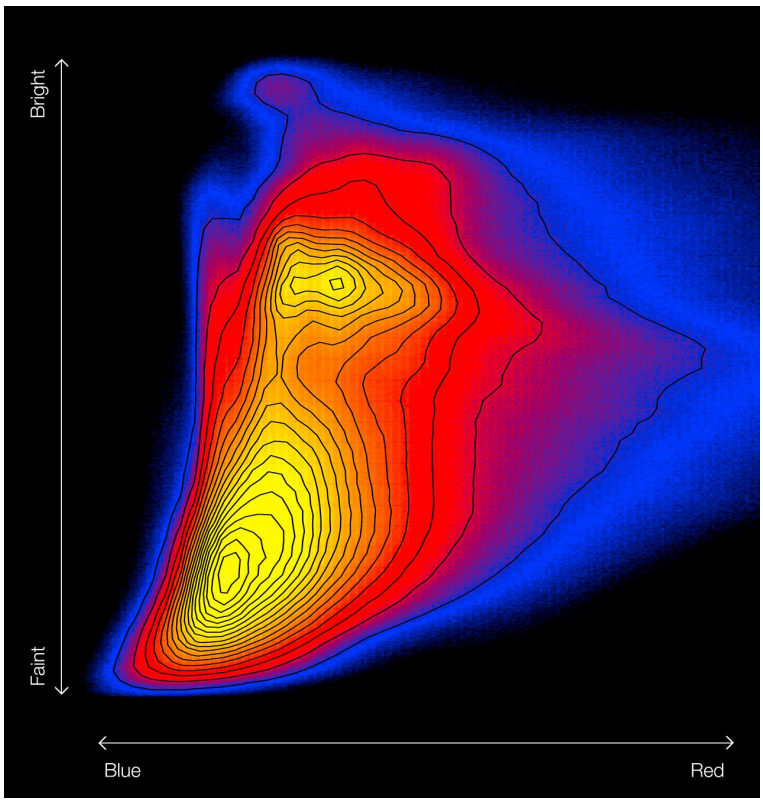

Fig.2. Color-magnitude diagram of the Galactic bulge. *Credit: ESO/VVV Consortium.*

[1] VVV stands for VISTA Variables in the Via Lactea.
[2] The team includes R. K. Saito, D. Minniti, B. Dias, J. Alonso-Garcia, B. Barbuy, M. Catelan, J. P. Emerson, O. A. Gonzalez, M. Hempel, P. W. Lucas, M. Rejkuba, and M. Zoccali.

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