

# Stellar variability in the VVV survey: overview and first results

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**Abstract.** The Vista Variables in the Vía Láctea (VVV) ESO Public Survey is an ongoing time-series, near-infrared (IR) survey of the Galactic bulge and an adjacent portion of the inner disk, covering 562 square degrees of the sky, using ESO's VISTA telescope. The survey has provided superb multi-color photometry in 5 broadband filters ( $Z$ ,  $Y$ ,  $J$ ,  $H$ , and  $K_s$ ), leading to the best map of the inner Milky Way ever obtained, particularly in the near-IR. The main part of the survey, which is focused on the variability in the  $K_s$ -band, is currently underway, with bulge fields observed between 34 and 73 times, and disk fields between 34 and 36 times. When the survey is complete, bulge (disk) fields will have been observed up to a total of 100 (60) times, providing unprecedented depth and time coverage in the near-IR. Here we provide a first overview of stellar variability in the VVV data.

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## 1. Overview

The VVV survey (Minniti *et al.* 2010, Catelan *et al.* 2011, Saito *et al.* 2012) has been monitoring the bulge and the southern disk in the  $K_s$ -band since 2010. It will provide, for the first time, a homogeneous database of long-baseline time-series photometry with up to 100 epochs for nearly  $10^9$  point sources. At present, when the extensive monitoring of the bulge fields has started, VVV has already provided a considerable number of epochs, suitable for analyses of stellar variability (Catelan *et al.* 2013). VVV provides a sparse time sampling, usually a single epoch for a few fields on a night (with an occasional second visit), distributed almost randomly over the seasonal visibility period of the area. Most of the currently available time-series data were taken in the third year of observations. An extensive overview of stellar variability in the current VVV Survey data, including detailed descriptions of the data, cadence, completeness, reduction and analysis techniques, and our efforts towards the automated classification of the VVV light curves, has recently been provided by Catelan *et al.* (2013), where one can also find examples of recent applications of these data, particularly in the context of Galactic structure. Sample light curves for many different variable star classes, including RR Lyrae, Cepheids (both classical and type II), long-period variables, eclipsing binaries, RS CVn systems, microlenses, novae, and transient events, are also provided.

## 2. Conclusions

VVV provides a treasure trove of scientific data that can be exploited in numerous scientific contexts. In terms of stellar variability, the project will provide up to several million (Catelan *et al.* 2013) calibrated  $K_s$ -band light curves for genuinely variable sources, including pulsating stars, eclipsing systems, rotating variables, cataclysmic stars, microlenses, planetary transits, and even transient events of unknown nature. At present, with the data-gathering phase of the VVV Survey having just crossed its half-way mark, we are really just taking the first steps in what will certainly be a long and exciting journey, during which it will be possible to address a myriad of time-domain astronomical applications. The latter include not only research on variable stars as such, but also their use as distance indicators and tracers of Galactic structure, origin, and evolution. Since VVV is a Public Survey, the data will quickly be made available to the entire astronomical community, opening the door to many additional applications and synergies with other ongoing and future projects that target the same fields as those covered by VVV.

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