Title:
Discovering the Galactic nursery through M-type stars

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Science Collaboration:
SMWLV

Start density in science fields (stars/deg square):
100000

Photometric filters required for science:
g
r
i

Photometric precision at r~24:

Approximate Sky Region:
Galactic Plane (~ |l| > 15, |b| < 10-20)

Desired pointings:

Discovering the Galactic nursery through M-type stars

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SCIENCE CASE: Extending the *g*, *r*, and *i* band wide-fast-deep (WFD) observing strategy of the LSST main survey also in the Galactic plane (GP), at |l| > 15°and |b| < 10-20°, will make a big difference in understanding star forming regions (SFRs). The exquisite LSST WFD photometric depth will allow us to **discover new very distant SFRs in different Galactic environments**, and detect the largest unknown **low-mass component of M-type stars ($\gtrsim$80%)** of very embedded SFRs in the solar neighbourhood. **QUANTITATIVE ANALYSIS:** The maximum distance to which pre-main sequence (PMS) stars can be detected depends on stellar mass, age and extinction. The LSST ten-years simulated magnitudes for the main survey are about 1.2 mag deeper than those planned for the GP. This difference corresponds to about a factor 1.7 in distance. Since the number of star clusters roughly increases in the GP with d^2, we will be able to discover a number of clusters at least a factor 3 larger than the one that would be discovered by adopting the observing strategy planned for the GP. Moreover, the exquisite LSST WFD co-added depth will enable to detect stars down to $0.1 M_\odot$ of highly embedded ($A_V \sim 5$) SFRs, up to ∼1.16 kpc, well beyond what could be achieved with 1.2 smaller limiting magnitudes (up to 0.67 kpc). This will allow a **complete** census of known embedded SFRs. Instead, in the less reddened regions of the GP, where the reddening is $A_V \sim 1$, it will be possible to assess the entire cluster population of very young stars down to $0.1\,M_\odot$ up to 10 kpc, involving a very large unexplored volume (e.g. in the direction of Vela-Puppis) that would be inaccessible otherwise. The proposed approach is based on the co-exploitation of three properties of very young M-type stars: a) the most common solar-metallicity M-dwarfs (dM) can be unambiguously selected in the *g-r* vs. *r-i* diagram; b) PMS M stars can be detected at a distance up to a factor 6 larger than dM stars being brighter by about 4 mag than these latter; c) direct and empirical measurement of individual A_V, crucial to derive individual mass and age of dM stars, can be obtained. The selection of young dM stars in distant SFRs is, consequently favoured by a significantly **higher stellar density** with respect to the more dispersed and uniformly distributed dM stars in the field, that, can only be detected up to a much lower distance and from which it can be spatially disentangled. **LSST UNIQUENESS:** The GP has a patchy structure including many crowded regions but also as many unexplored obscured regions. The average stellar density found with Gaia at G< 20 is ∼100,000 per sq.deg but in low extinction regions of the GP. LSST, with its ≃7 deeper magnitudes, will allow us to obtain the same stellar density, but in many of the unexplored obscured regions ($A_V \sim 5 - 10$), inaccessible with Gaia. Our knowledge of SFRs is currently limited to nearby regions, while LSST observations will allow us to discover SFRs at distances 7 times farther than those achievable even with the deepest wide-area surveys, e.g. PanSTARRS1. This implies that with LSST we will be able to discover a number of SFRs at least a factor 50 larger than the one that would be discovered using PanSTARRS1. The LSST WFD final co-added depth will enable us to discover the very low mass population of the SFRs at distances that are inaccessible even with deep IR photometric surveys. In fact, the latter only allow us to discover samples biased in favour of young stars with circumstellar disks, while the proposed approach enables us to select larger samples of PMS M-type stars, irrespective of the presence of a disk. (Further details and references can be found in the White Paper by Prisinzano, Magrini et al. (2018, https://www.lsst.org/submitted-whitepaper-2018, 2018arXiv181203025P).