

**OBSERVING REQUEST**  
**University of Arizona Observatories**

**Year:** 2017

**Term:** Jul–Dec

**Proposal type:** short-term

## High-resolution integrated-light spectroscopy of M33 Globular Cluster System

**P.I.:** Borja Anguiano (UVa; *astrobaj@gmail.com*; 434-243-5594)

**CoI(s):** \_\_\_\_\_  
\_\_\_\_\_  
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### Abstract of Scientific Justification

The nearby spiral Triangulum Galaxy (M33) is the third most massive galaxy in the Local Group although in comparison with the Milky Way (MW), Andromeda (M31) and the Magellanic Clouds (MCs) is much less studied. The Pan-Andromeda Archaeological Survey (PANDAS) revealed large-scale substructures of low surface brightness, including arcs, stream and globular clusters, connecting M31 and M33 galaxies (Huxor et al. 2011). Substructure in our own Galactic halo reveals its merger history, and certain globular clusters (GCs) appear to specific accreted satellites (e.g., Sagittarius dwarf spheroidal galaxy). Hence, Globular Cluster Systems (GCSs) can be used as tracers of the formation processes and the assembly history of a galaxy. Here we propose a detailed multi-object high-resolution spectroscopy survey of the M33 GCS using MMT-Hectochelle. A total of 595 objects are classified as high-confidence clusters based on HST and high-resolution groundbased imaging on existing photometric catalogues of M33 star clusters, however, to date there is integrated-light (IL) spectroscopy for only 12 M33 GCs at optical wavelengths (Beasley et al. 2015) and none in the infrared (IR).

### UVA GTO proposal

### Summary of observing runs requested for this project

Run	Telescope	Cage	Instrument	PI	AO	Nights	Moon	Scheduling		Sharing	
								Optimal	Acceptable	Poss.	Adv.
1	MMT		Hectochelle			2	bright	Nov–Dec	Oct–Dec	no	no

**Scheduling constraints and unusable dates (up to 4 lines):** \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

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A \* appended to the proposal type indicates a continuation proposal; a \* appended to the name of a proposer indicates the proposer is a (graduate) student; a proposer whose name is underlined is certified on the proposed telescope/instrument combination; if a \* appears within the PI or AO box in the observations summary table, the instrument is a PI instrument and/or Adaptive Optics are requested – signatures are required on the next page.

Target list (attach list if longer than 26 objects)				
#	Object	RA	Dec	mag / color / type / redshift / comment / etc.
1	M33	01:33:50	+30:39:37	clusters in the galaxy

Approval for Instrument Use from PI: \_\_\_\_\_

*(have instrument PI signature appear on, or attach PI e-mail to, all copies)*

**Graduate students** (provide the following information if student is PI on the cover page or if this is a 2nd-year or Thesis program. Send confirmation email to TAC chair in place of signature.)

Student's Name	Advisor's Name	Advisor's Signature	2nd-yr	Thesis

<b>Scientific Justification</b>
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**Experimental Design & Technical Description** *Describe your overall observational program. How will these observations contribute toward the accomplishment of the goals outlined in the science justification? If you've requested long-term status, justify why this is necessary for successful completion of the science. (up to one page)*

**Summary of Time Requested and Awarded**

The TAC needs to understand the scope of this project — (1) tell us how many UAO nights you've already had for this project, how many you request this time, and (a good guess of) how many you need to complete the project; (2) if a substantial amount of observing for this project comes from non-UAO telescopes, tell us about that observing, and how the UAO part fits in; (3) if you are collaborating with people who have telescopes, especially if you are part of a large collaboration, tell us who is leading the project, and how UAO time and your participation fit in. (***up to one page***)

<b>Previous Use of Steward Facilities</b>
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List **all** allocations of telescope time for the present project and allocations for other projects on facilities available through UAO during the past 2 years, together with the current status of the data (cite publications where appropriate). Mark those allocations related to the present proposal (i.e, precede text with `\related` command). (***up to one page***)

<b>Other Information</b>
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Provide any additional program-related information including, for example, relation of current program to externally funded research, to the development of expanded capabilities for UA telescopes, or to individual timescales (e.g. PI is finishing postdoc appointment and this request would complete program). (***up to one page***)