14595 - Correlating proper motion kinematics with stellar properties in a very young protocluster

Cycle: 24, Proposal Category: GO
(Availability Mode: SUPPORTED)

INVESTIGATORS

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<tr>
<th>Name</th>
<th>Institution</th>
<th>E-Mail</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dr. Nicola Da Rio (PI) (Contact)</td>
<td>University of Florida</td>
<td><a href="mailto:ndario@ufl.edu">ndario@ufl.edu</a></td>
</tr>
<tr>
<td>Prof. Jonathan Charles Tan (CoI)</td>
<td>University of Florida</td>
<td><a href="mailto:jt@astro.ufl.edu">jt@astro.ufl.edu</a></td>
</tr>
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<td>Gemini Observatory, Southern Operations</td>
<td><a href="mailto:manderse@gemini.edu">manderse@gemini.edu</a></td>
</tr>
<tr>
<td>Dr. Jessica Ryan Lu (CoI)</td>
<td>University of California - Berkeley</td>
<td><a href="mailto:jlu.astro@berkeley.edu">jlu.astro@berkeley.edu</a></td>
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VISITS

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ABSTRACT
We recently obtained the first epoch of a multi-cycle HST program (GO13742) aimed at the study of massive star cluster formation through proper motion-based analysis of kinematics. This program targeted the young, gas-dominated, still-forming protocluster G286 with WFC3/IR J, H and narrow band F167N, reaching down to the H-burning limit at A_V=20, and well into the substellar regime for the less-embedded parts of the system. With the second epoch (cycle 24) we will derive proper motions, kinematic subclustering, runaway objects and determine the overall expansion/contraction of the system.

Here we propose to complement these observations with additional photometric bands, which will allow us to derive the stellar parameters of the low-mass members. We plan to use the H2O Teff band at 1.4micron, with a continuum at 1.3micron, to disentangle Teff and A_V for all low-mass young stars down to the H-burning limit at A_V=20, matching our previous data. This will enable us to construct the HRD, assign ages, look for spatial age gradients, and compare kinematic properties with age. Specifically, the identification of systematic variations in the proper motions with age will enable us to trace the initial morphology of the system at its formation, and determine the kinematic association of older stars with younger. Last, we plan to obtain accurate fluxes in Paschen beta, whose excess is indicative of accretion (allowing us to measure Mdot) and is an independent indicator of membership.

Accretion properties, with ages, masses, and dynamics will enable a comprehensive picture of this young, massive protocluster in formation, testing theories of massive star cluster formation.

OBSERVING DESCRIPTION
This is a manually defined 3x3 mosaic with WFC3/IR
Each tile/visit covers one orbit.
For each tile 3 exposures are taken in F128N and F130N, and 2 in F139M, all dithered.

We impose two small ranges of orient angles (with 180 rotation between them), so that the final coverage will closely match that of the 3x3 mosaic of our previous program GO13742. This is needed since the data of both programs will have to be analyzed together.
Visit 3 is rotated 90 degrees, as it ended up being reobserved in program GO13742 after with its original orientation no guide star could be used by the telescope.
**Proposal 14595 - Visit 01 - Correlating proper motion kinematics with stellar properties in a very young protocluster**

**Diagnostic Status:** No Diagnostics

**Scientific Instruments:** WFC3/IR

**Special Requirements:** ORIENT 210D TO 220 D; ORIENT 30D TO 40 D

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## Proposal 14595 - Visit 02 - Correlating proper motion kinematics with stellar properties in a very young protocluster

### Visit Diagnostic Status: No Diagnostics
Scientific Instruments: WFC3/IR
Special Requirements: ORIENT 210D TO 220 D; ORIENT 30D TO 40 D

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Proposal 14595 - Visit 02 - Correlating proper motion kinematics with stellar properties in a very young protocluster
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Proposal 14595 - Visit 03 - Correlating proper motion kinematics with stellar properties in a very young protocluster
Proposal 14595 - Visit 04 - Correlating proper motion kinematics with stellar properties in a very young protocluster  

**Visit**  
**Diagnostic Status:** No Diagnostics  
**Scientific Instruments:** WFC3/IR  
**Special Requirements:** ORIENT 210D TO 220 D; ORIENT 30D TO 40 D

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Equinox: J2000 | V=9.0+-0.5 | Reference Frame: ICRS |

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Proposal 14595 - Visit 04 - Correlating proper motion kinematics with stellar properties in a very young protocluster

Orbit Structure
### Proposal 14595 - Visit 05 - Correlating proper motion kinematics with stellar properties in a very young protocluster

**Diagnostic Status:** No Diagnostics  
**Scientific Instruments:** WFC3/IR  
**Special Requirements:** ORIENT 210D TO 220 D; ORIENT 30D TO 40 D

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Dec: -58 19 22.24 (-58.32284d)  
Equinox: J2000 | V=9.0+/-0.5 | Reference Frame: ICRS |

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Orbit Structure

Proposal 14595 - Visit 05 - Correlating proper motion kinematics with stellar properties in a very young protocluster
### Proposal 14595 - Visit 06 - Correlating proper motion kinematics with stellar properties in a very young protocluster

**Visit**
- Diagnostic Status: No Diagnostics
- Scientific Instruments: WFC3/IR
- Special Requirements: ORIENT 210D TO 220 D; ORIENT 30D TO 40 D

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Proposal 14595 - Visit 06 - Correlating proper motion kinematics with stellar properties in a very young protocluster
Proposal 14595 - Visit 07 - Correlating proper motion kinematics with stellar properties in a very young protocluster

**Visit**
- **Diagnostic Status:** No Diagnostics
- **Scientific Instruments:** WFC3/IR
- **Special Requirements:** ORIENT 210 D TO 220 D; ORIENT 30 D TO 40 D

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Proposal 14595 - Visit 07 - Correlating proper motion kinematics with stellar properties in a very young protocluster
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Proposal 14595 - Visit 08 - Correlating proper motion kinematics with stellar properties in a very young protocluster
Proposal 14595 - Visit 09 - Correlating proper motion kinematics with stellar properties in a very young protocluster

Visit
Proposal 14595, Visit 09
Diagnostic Status: No Diagnostics
Scientific Instruments: WFC3/IR
Special Requirements: ORIENT 210D TO 220 D; ORIENT 30D TO 40 D

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Fixed Targets

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Proposal 14595 - Visit 09 - Correlating proper motion kinematics with stellar properties in a very young protocluster