NOAO Observing Proposal *Standard proposal* **Panel:** *For office use.*
Date: May 14, 2019 **Category:** Star Clusters

Star and Planet Formation in a High-Radiation Environment

Abstract of Scientific Justification *(will be made publicly available for accepted proposals)***:**
We are studying the effects of stellar environment on protoplanetary disk evolution, with implications for planet formation theory. Our case study of one young cluster near cometary globule CG 30 suggests the Gum Nebula's high-radiation environment is eroding protoplanetary disks early; the fraction of stars with accreting disks is significantly less than the fractions in coeval, more quiescent star-forming regions (e.g. Taurus). We will examine 7 newly discovered clusters inside the Gum Nebula, all $<$450 pc away, to see if they also show evidence of early disk erosion. We can use CHIRON and Goodman to confirm stars' cluster membership using radial velocities and Li I 6708 signatures of youth, check directly for disk presence using Hα emission from accretion, and check indirectly for disk presence using stellar rotation speeds > 30 km s^{-1}. This study will additionally map stellar populations within the Gum Nebula and perhaps shed light on the nebula's as-yet mysterious origin.

Summary of observing runs requested for this project

Run	Telescope	Instrument	No. Nights	Moon	Optimal months	Accept. months
1	CT-1.5m-SVC	CHIRON	7.7	bright	Dec - Jan	Nov - Jan
2	SOAR	Goodman	6.9	bright	Dec - Jan	Nov - Jan
3						
4						
5						
6						

Scheduling constraints and non-usable dates *(up to six lines).*

We kindly request that if this proposal and the proposal by co-investigator Azmain Nisak titled "Confirmation of New Candidate Members in Young Open Clusters IC 2602 and IC 2391" are awarded Goodman time, that the runs be scheduled sequentially so that we can travel and observe together (we are both at the same institution).

Investigators *List the name, status, and current affiliation for all investigators. The status code of "P" should be used for all investigators with a Ph.D. or equivalent degree. For graduate students, use "T" if this proposal is a significant part of their thesis project, otherwise use "G".*

PI: Alexandra Yep **Status:** T **Affil.:** Georgia State University
Physics and Astronomy, 25 Park Pl, Atlanta, GA 30303
Email: ayep@astro.gsu.edu Phone: 818-939-2313 FAX: ________

CoI: Russel White **Status:** P **Affil.:** Georgia State University
CoI: Azmain Nisak **Status:** G **Affil.:** Georgia State University

Scientific Justification *Be sure to include overall significance to astronomy. For standard proposals limit text to one page with figures, captions and references on no more than two additional pages.*

Planets do not form in a vacuum. They aggregate in the protoplanetary disks of young stars. Stars do not form in a vacuum either. They compact inside clouds of gas and dust, often in the company of other stars (Lada & Lada 2003). Does such an environment affect star formation, and ultimately planet formation? As 90% of stars form in the company of other stars, including massive bright ones, it is important we understand their effects on each other.

We are studying young stars in the little-known Gum Nebula (Gum 1952), where hot O-type stars shine so fiercely they evaporate dense cloud cores into comet-like shapes. Near and even inside these so-called cometary globules, several stellar clusters have formed (Kim et al. 2005; Yep & White 2019, under review). Our case study of one young cluster near cometary globule CG 30 suggests the Gum Nebula's high-radiation environment is eroding protoplanetary disks early; the cluster's fraction of stars with accretion disks is significantly less than the fractions in coeval, more quiescent star-forming regions (e.g. Taurus) (Mohanty et al. 2005). Such disk dispersal could limit time available for planet formation.

To investigate this phenomenon more completely, we need a larger sample. Implementing a simple Python code we developed that visualizes Gaia DR2 proper motions and distances, we have discovered 7 other star clusters inside the Gum Nebula, each with between 15 and 347 candidate members. The fact that these clusters <450 pc away have heretofore evaded attention attests to how under-studied the Gum Nebula is.

Here we propose to obtain high-dispersion spectra of the complete sample of candidate cluster members brighter than $V = 14$ with CHIRON and modest-dispersion spctra of the single-star sample $14 < V < 16$ with Goodman. With these spectra we can measure spectral types, youth-indicating Li λ6708 equivalent widths, and radial velocities to confirm cluster membership and probe the overall dynamics (expanding, contracting, or neither) of the Gum Nebula. We will then explore stars' disk properties directly with Hα emission and continuum excess emission from accretion processes in the 5 youngest clusters (near CG 4, 3, 14, 30, and 22, see Fig. 1), and indirectly with stellar rotation speeds in the 3 older clusters (near CG 1, CG 17, and GDC 1). That is, because a protoplanetary disk slows a star's rotation more effectively than mere stellar winds, a star whose disk is dispersed early will theoretically retain a relatively fast rotation speed for its age, for as long as a few 100 Myr (Bouvier et al. 2014).

In summary, low accretion disk fractions and relatively fast rotation speeds may indicate early disk dispersal. We will elucidate the origin of the Gum Nebula and ascertain whether a high-radiation environment disrupts protoplanetary disks early, shortening their time available for forming planets and possibly leading to constraints on planet formation theory.

This work is done in conjunction with Azmain Nisak's study of the young clusters IC 2602 and IC 2391. We are both using CHIRON and Goodman to gather spectra of young and adolescent stars and are building a catalogue of CHIRON and Goodman spectral standards for public use.

References

Bouvier, J., S. P. Matt, S. Mohanty, et al. 2014, arXiv, 1309.7851v1
Gum, C. S. 1952, Observatory, 72, 151
Lada, J. C., & E. A. Lada. 2003, ARA&A, 41, 57
Kim, J. S., F. M. Walter, & S. J. Wolk. 2005, ApJ, 129, 1564
Mohanty, S., R. Jayawardhana, & G. Basri. 2005, ApJ, 626, 498
Yep, A. C., & R. J. White. 2019, ApJ, under review

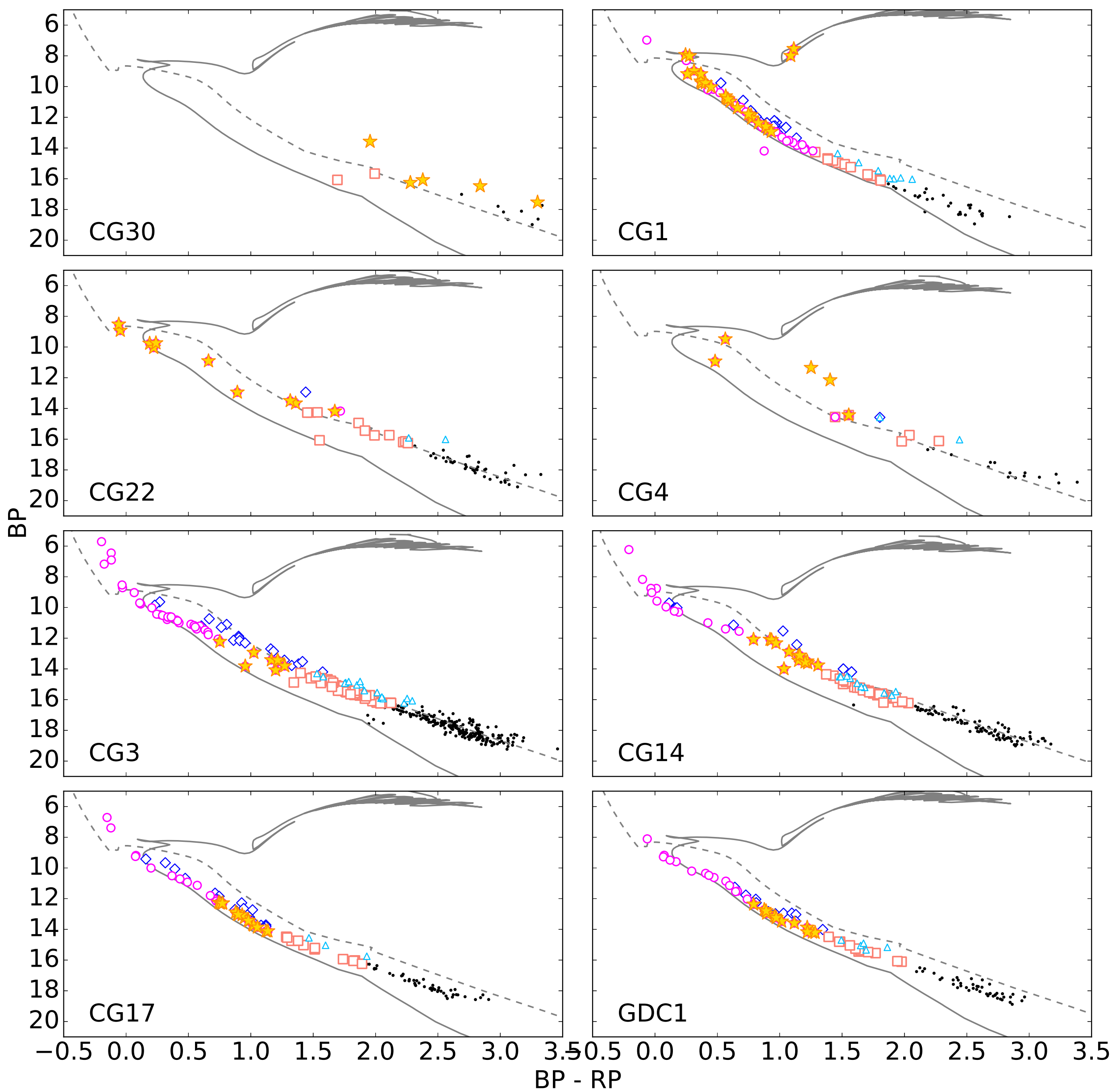

Figure 1: Plotted are uncorrected Gaia DR2 color-magnitude diagrams of CG 30 and the 7 newly identified clusters in the Gum Nebula. Gold star symbols represent stars we have already observed with CHIRON. Magenta circles and blue diamonds represent unobserved single and binary stars, respectively, bright enough to observe with CHIRON. Salmon squares and sky blue triangles are unobserved single and binary stars, respectively, that can be observed with Goodman. Black dots are the remaining dimmer stars, possibly observable with Goodman but not yet considered in this proposal. The 4 Myr (dashed) and 1 Gyr (solid) isochrones are from Padova.

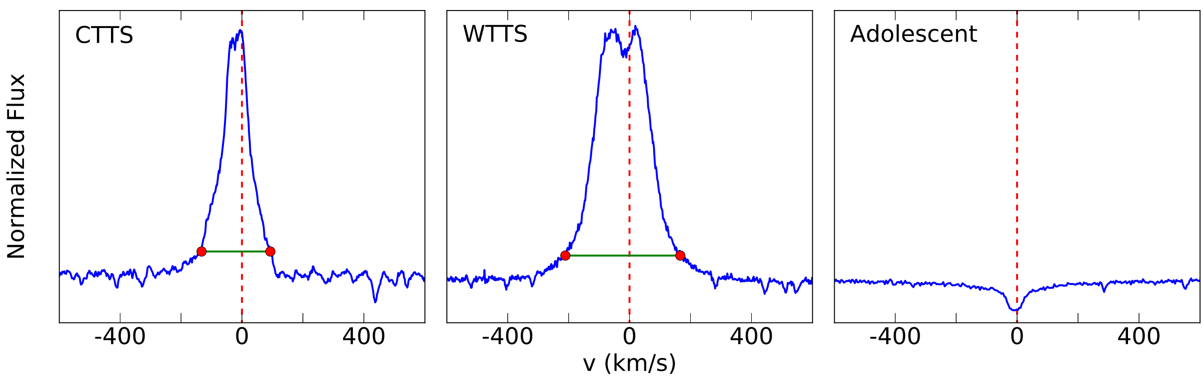

Figure 2: Shown are normalized Hα line profiles vs. velocity. A broad emission line is associated with accretion from a protoplanetary disk (left, classical T Tauri Star). A thin emission line indicates possible chromospheric activity but no gaseous disk and no accretion (middle, weak-line T Tauri star). Absorption means no gaseous disk and no accretion (right, adolescent or main sequence star).

Experimental Design *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. (limit text to one page)*

All 8 clusters are in the Southern hemisphere and under 450 pc away, well suited to CHIRON and Goodman's location and aperture size. The wavelength ranges ∼4500 – 8500 Å encompass atomic lines for judging spectral type and continuum excess, Li I $\lambda6708$ for youth, Hα for accretion, and the telluric A-band at 7600 – 7630 Å for calibration of the wavelength solution. CHIRON's resolving power of $R \approx 25,000$ and Goodman's $R \approx 10,000$ allow for a velocity resolution of 12 km s^{-1} for brighter stars ($V < 14$) and 30 km s^{-1} for dimmer stars, enough to obtain cross-correlation-derived radial and rotational velocity precisions of a few km s^{-1}. This is sufficient for evaluating cluster membership, average cluster motions, and rapid rotation (especially rapid rotation >30 km s^{-1}).

To confirm the success of our cluster member selection criteria, we secured a small allotment of CHIRON time through GSU's SMARTs involvement. This was used to observe the brightest subset in 3 clusters, focusing on A stars at the turn-off, giants, and a handful of F and G stars. Here we propose for a more complete assessment of the solar mass population. We will gather spectra of all 95 remaining single stars and ideally all 78 remaining binary stars within CHIRON's brightness capability (down to $V = 14$, 15 for the small distant cluster CG 4), and Goodman spectra of ideally all 93 single stars $14 < V < 16$ in all 5 young clusters (near CG 4, 3, 14, 30, and 22).

Obtaining all stars $V < 14$ with CHIRON and all single young stars with $14 < V < 16$ with Goodman will furnish us with a marvelously complete magnitude-limited census of Gum Nebula cluster members. If time does not allow for this, however, we will prioritize single stars with CHIRON, and CG 4, 14, 30, and 22 stars with Goodman.

Proprietary Period: 18 months

Use of Other Facilities or Resources *(1) Describe how the proposed observations complement data from non-NOAO facilities. For each of these other facilities, indicate the nature of the observations (yours or those of others), and describe the importance of the observations proposed here in the context of the entire program. (2) Do you currently have a grant that would provide resources to support the data processing, analysis, and publication of the observations proposed here?"*

We will buttress our current spectroscopic study of disk properties with archival infrared photometry from 2MASS, WISE, and Spitzer, which can measure dust-caused infrared excess in young as well as more evolved disks. This infrared excess data is especially important for stars in the 3 older clusters in our sample (near CG 1, CG 17, and GDC 1), whose stars are likely no longer emitting in Hα. We will gather infrared data on stars both young and old, all 946 if available.

Light curves from TESS could potentially provide direct stellar rotation period measurements in support of our spectroscopic measurements of stellar rotation speeds. As mentioned, relatively fast stellar rotation speeds, or short periods, could be associated with early loss of circumstellar disks.

Distances and proper motions from Gaia DR2 have tremendously furthered this project. Adding spectroscopically determined radial velocities will enable us, through average cluster motions, to track the dynamics of the mysterious Gum Nebula.

We do not currently have a grant dedicated to this thesis project but have applied to NASA's FINESST grant and Sigma Xi's Grants-In-Aid of Research.

Previous Use of NOAO Facilities *List allocations of telescope time on facilities available through NOAO to the PI during the last 2 years for regular proposals, and at any time in the past for survey proposals (including participation of the PI as a Co-I on previous NOAO surveys), together with the current status of the data (cite publications where appropriate). Mark with an asterisk those allocations of time related to the current proposal. Please include original proposal semesters and ID numbers when available.*

40 hr of CHIRON time* through the SMARTS Consortium, of which Georgia State University is a member. Spectra are reduced and prepared for stellar analysis. We are currently creating a normalization prescription that is optimized for cross-correlation analyses. We plan to publish initial results, including the discovery of the 7 new clusters, this fall.

Observing Run Details for Run 1: CT-1.5m-SVC/CHIRON

Technical Description *Describe the observations to be made during this observing run. Justify the specific telescope, the number of nights, the instrument, and the lunar phase. List objects, coordinates, and magnitudes (or surface brightness, if appropriate) in the Target Tables section below (required for queue and Gemini runs).*

Continuing our current setup carried out on SMARTS Consortium time, we will use CHIRON in fiber mode to collect one spectrum each of the remaining 95 $V < 14$ single stars (see Fig. 1, magenta circles) and 78 $V < 14$ binary stars (see Fig. 1, blue diamonds) in the 7 new clusters (the CG 30 cluster has no unobserved $V < 14$ members). Single stars (in Run 1 Target Tables 1 and 2) are simpler to analyze than binary stars (in Run 1 Target Tables 3 and 4) and so are prioritized, but ideally we will observe all remaining 173 $V < 14$ stars, both single and binary.

We are aiming for SNR $30 - 10$, which should suffice to determine each star's spectral type, radial velocity, stellar rotational speed, continuum excess, Hα emission, and Li absorption equivalent width. We limit exposure time for magnitudes $V > 9.3$ to 1200 s in the interest of surveying all single and binary stars in a timely manner. The long continuous exposure time introduces a small barycentric correction error, which should be negligible beside the few km s^{-1} precision of our radial-velocity-calculating cross-correlation procedure.

Having previously employed the above setup to queue or acquire CHIRON spectra of 89 stars, with which we are very happy, we are confident the setup will serve our purposes well.

Target table ID key: 000: Spectral standards; 100: CG 1; 200: CG 4; 300: CG 3; 400: CG 14; 500: GDC 1; 600: CG 30; 700: CG 17; 800: CG 22.

Instrument Configuration

Filters: n/a
Grating/grism: R2 Echelle Grating
Order: n/a
Cross disperser: LF7 prism

Slit: n/a
Multislit: no
λ_{start}: 4150
λ_{end}: 8800

Fiber cable:
Corrector: n/a
Collimator: F = 600 mm
Atmos. disp. corr.:

R.A. range of principal targets (hours): 7 to 9

Dec. range of principal targets (degrees): -55 to -34

Special Instrument Requirements *Describe briefly any special or non-standard usage of instrumentation.*

Target Table for Run 1: CT-1.5m-SVC/CHIRON

Obj ID	Object	α	δ	Epoch	Mag.	Filter	Exp. time	# of exp.	Lunar days	Sky	Seeing	Comment
100	CG1-000	7 3 33.833	-45 31 55.828	J2000	11.127		1200	1	14	spec	1.0	
101	CG1-001	7 7 27.516	-47 23 0.081	J2000	10.176		1200	1	14	spec	1.0	
102	CG1-002	7 8 30.993	-45 48 39.18	J2000	13.597		1200	1	14	spec	1.0	
103	CG1-003	7 8 58.128	-45 19 52.683	J2000	6.773		116	1	14	spec	1.0	
104	CG1-004	7 9 57.789	-46 32 30.508	J2000	12.385		1200	1	14	spec	1.0	
105	CG1-005	7 12 24.007	-45 22 46.627	J2000	12.398		1200	1	14	spec	1.0	
106	CG1-006	7 12 26.782	-45 59 17.125	J2000	13.806		1200	1	14	spec	1.0	
107	CG1-007	7 12 33.549	-44 34 7.641	J2000	13.954		1200	1	14	spec	1.0	
108	CG1-008	7 13 33.705	-47 13 22.339	J2000	9.958		1200	1	14	spec	1.0	
109	CG1-009	7 14 7.429	-46 28 54.932	J2000	13.417		1200	1	14	spec	1.0	
110	CG1-010	7 14 20.301	-47 56 4.03	J2000	10.662		1200	1	14	spec	1.0	
111	CG1-011	7 14 40.055	-46 20 52.815	J2000	10.575		1200	1	14	spec	1.0	
112	CG1-012	7 16 20.919	-46 30 41.91	J2000	13.073		1200	1	14	spec	1.0	
113	CG1-013	7 16 24.292	-45 20 38.234	J2000	13.272		1200	1	14	spec	1.0	
114	CG1-014	7 16 35.309	-46 41 55.496	J2000	11.021		1200	1	14	spec	1.0	
115	CG1-015	7 16 35.961	-46 14 16.894	J2000	8.094		391	1	14	spec	1.0	
116	CG1-016	7 16 44.445	-45 31 1.948	J2000	11.429		1200	1	14	spec	1.0	
117	CG1-017	7 18 46.592	-45 35 23.227	J2000	13.326		1200	1	14	spec	1.0	
118	CG1-018	7 19 30.689	-46 15 12.607	J2000	13.862		1200	1	14	spec	1.0	
119	CG1-019	7 21 22.335	-46 0 9.452	J2000	11.769		1200	1	14	spec	1.0	
120	CG1-020	7 21 52.073	-45 28 44.339	J2000	12.719		1200	1	14	spec	1.0	
121	CG1-021	7 23 18.167	-46 16 26.24	J2000	13.969		1200	1	14	spec	1.0	
122	CG1-022	7 24 39.5	-45 57 13.797	J2000	13.553		1200	1	14	spec	1.0	
123	CG1-023	7 25 48.131	-47 2 27.48	J2000	12.514		1200	1	14	spec	1.0	
124	CG1-024	7 25 49.821	-47 2 5.858	J2000	10.593		1200	1	14	spec	1.0	
125	CG1-025	7 31 30.795	-44 49 30.2	J2000	10.001		1200	1	14	spec	1.0	
200	CG4-000	7 29 32.903	-46 11 3.618	J2000	14.318		1200	1	14	spec	1.0	
300	nCG3-000	7 37 33.059	-46 11 44.926	J2000	10.993		1200	1	14	spec	1.0	
301	nCG3-001	7 42 13.012	-45 30 37.668	J2000	11.248		1200	1	14	spec	1.0	
302	nCG3-002	7 42 36.524	-48 17 33.672	J2000	10.783		1200	1	14	spec	1.0	
303	nCG3-003	7 43 8.382	-46 16 21.201	J2000	11.397		1200	1	14	spec	1.0	
304	nCG3-004	7 44 35.346	-47 23 6.101	J2000	10.226		1200	1	14	spec	1.0	
305	nCG3-005	7 45 55.207	-46 45 20.103	J2000	10.422		1200	1	14	spec	1.0	
306	nCG3-006	7 47 19.246	-48 29 13.12	J2000	10.604		1200	1	14	spec	1.0	
307	nCG3-007	7 47 35.21	-47 0 46.638	J2000	6.708		109	1	14	spec	1.0	
308	nCG3-008	7 47 58.071	-48 26 25.136	J2000	10.307		1200	1	14	spec	1.0	
309	nCG3-009	7 48 56.66	-46 37 19.002	J2000	8.827		768	1	14	spec	1.0	
310	nCG3-010	7 48 56.874	-46 37 18.836	J2000	9.815		1200	1	14	spec	1.0	
311	nCG3-011	7 49 12.863	-46 51 27.782	J2000	5.516		36	1	14	spec	1.0	
312	nCG3-012	7 49 18.462	-46 57 43.249	J2000	10.957		1200	1	14	spec	1.0	
313	nCG3-013	7 49 42.534	-46 22 54.129	J2000	11.055		1200	1	14	spec	1.0	
314	nCG3-014	7 50 15.183	-46 16 3.373	J2000	11.840		1200	1	14	spec	1.0	
315	nCG3-015	7 50 23.947	-48 53 31.292	J2000	10.660		1200	1	14	spec	1.0	
316	nCG3-016	7 50 45.788	-46 19 36.238	J2000	8.332		486	1	14	spec	1.0	
317	nCG3-017	7 51 13.973	-47 12 59.086	J2000	6.253		72	1	14	spec	1.0	
318	nCG3-018	7 51 31.453	-47 5 44.614	J2000	10.259		1200	1	14	spec	1.0	
319	nCG3-019	7 52 2.417	-47 2 42.02	J2000	10.387		1200	1	14	spec	1.0	
320	nCG3-020	7 52 18.177	-48 41 7.152	J2000	8.510		573	1	14	spec	1.0	
321	nCG3-021	7 52 47.052	-47 12 59.684	J2000	10.876		1200	1	14	spec	1.0	
322	nCG3-022	7 53 0.564	-45 57 4.253	J2000	9.567		1200	1	14	spec	1.0	

Target Table for Run 1: CT-1.5m-SVC/CHIRON

Obj ID	Object	α	δ	Epoch	Mag.	Filter	Exp. time	# of exp.	Lunar days	Sky	Seeing	Comment
323	nCG3-023	7 53 24.675	-46 57 57.275	J2000	9.497		1200	1	14	spec	1.0	
324	nCG3-024	7 54 22.37	-46 47 9.995	J2000	10.407		1200	1	14	spec	1.0	
325	nCG3-025	7 55 6.815	-46 41 24.59	J2000	10.403		1200	1	14	spec	1.0	
326	nCG3-026	7 56 24.23	-46 52 47.741	J2000	10.570		1200	1	14	spec	1.0	
327	nCG3-027	7 57 38.072	-46 35 35.84	J2000	6.977		140	1	14	spec	1.0	
328	nCG3-028	7 59 50.029	-49 1 52.345	J2000	11.554		1200	1	14	spec	1.0	
329	nCG3-029	8 2 15.524	-49 34 6.58	J2000	11.183		1200	1	14	spec	1.0	
330	nCG3-030	8 5 48.107	-46 14 17.39	J2000	10.433		1200	1	14	spec	1.0	
400	nCG14-000	7 42 36.524	-48 17 33.672	J2000	10.783		1200	1	14	spec	1.0	
401	nCG14-001	7 56 7.587	-47 49 47.786	J2000	10.030		1200	1	14	spec	1.0	
402	nCG14-002	7 58 0.75	-46 6 13.264	J2000	9.379		1200	1	14	spec	1.0	
403	nCG14-003	7 58 0.891	-49 1 12.143	J2000	8.552		595	1	14	spec	1.0	
404	nCG14-004	7 58 52.78	-45 53 2.979	J2000	10.096		1200	1	14	spec	1.0	
405	nCG14-005	7 59 12.306	-49 58 36.663	J2000	6.034		59	1	14	spec	1.0	
406	nCG14-006	8 2 15.524	-49 34 6.58	J2000	11.183		1200	1	14	spec	1.0	
407	nCG14-007	8 3 37.664	-48 59 17.017	J2000	8.830		769	1	14	spec	1.0	
408	nCG14-008	8 4 1.038	-50 5 19.879	J2000	11.328		1200	1	14	spec	1.0	
409	nCG14-009	8 8 41.608	-49 29 50.017	J2000	7.971		349	1	14	spec	1.0	
500	GDC1-000	8 17 13.892	-51 41 59.834	J2000	9.386		1200	1	14	spec	1.0	
501	GDC1-001	8 18 0.746	-48 31 11.88	J2000	10.270		1200	1	14	spec	1.0	
502	GDC1-002	8 24 15.891	-49 42 11.505	J2000	11.295		1200	1	14	spec	1.0	
503	GDC1-003	8 25 57.83	-51 17 50.225	J2000	10.645		1200	1	14	spec	1.0	
504	GDC1-004	8 26 26.023	-50 53 33.952	J2000	10.409		1200	1	14	spec	1.0	
505	GDC1-005	8 27 1.494	-50 3 31.99	J2000	8.971		876	1	14	spec	1.0	
506	GDC1-006	8 27 2.388	-50 22 26.598	J2000	9.994		1200	1	14	spec	1.0	
507	GDC1-007	8 28 4.321	-51 14 7.51	J2000	7.906		329	1	14	spec	1.0	
508	GDC1-008	8 28 9.932	-49 14 56.121	J2000	10.926		1200	1	14	spec	1.0	
509	GDC1-009	8 29 29.14	-50 56 17.619	J2000	10.139		1200	1	14	spec	1.0	
510	GDC1-010	8 29 57.017	-51 24 48.711	J2000	11.809		1200	1	14	spec	1.0	
511	GDC1-011	8 32 51.926	-52 32 52.914	J2000	9.073		963	1	14	spec	1.0	
512	GDC1-012	8 36 9.264	-53 28 42.141	J2000	9.284		1169	1	14	spec	1.0	
513	GDC1-013	8 36 55.755	-52 59 1.911	J2000	11.322		1200	1	14	spec	1.0	
700	nCG17-000	8 29 15.592	-50 15 0.253	J2000	8.982		886	1	14	spec	1.0	
701	nCG17-001	8 34 9.587	-53 4 17.413	J2000	6.516		91	1	14	spec	1.0	
702	nCG17-002	8 35 29.44	-51 48 54.696	J2000	11.830		1200	1	14	spec	1.0	
703	nCG17-003	8 36 3.843	-51 6 9.832	J2000	9.797		1200	1	14	spec	1.0	
704	nCG17-004	8 36 47.539	-53 16 41.395	J2000	10.915		1200	1	14	spec	1.0	
705	nCG17-005	8 37 39.276	-51 38 22.042	J2000	10.297		1200	1	14	spec	1.0	
706	nCG17-006	8 38 51.737	-52 9 45.607	J2000	9.047		940	1	14	spec	1.0	
707	nCG17-007	8 39 13.379	-51 18 20.273	J2000	10.712		1200	1	14	spec	1.0	
708	nCG17-008	8 39 54.099	-51 56 51.345	J2000	11.942		1200	1	14	spec	1.0	
709	nCG17-009	8 40 8.351	-51 56 29.607	J2000	7.194		170	1	14	spec	1.0	
710	nCG17-010	8 45 7.18	-53 30 34.896	J2000	11.579		1200	1	14	spec	1.0	
711	nCG17-011	8 50 27.105	-54 7 54.085	J2000	10.501		1200	1	14	spec	1.0	
800	CG22-000	8 25 28.242	-35 31 26.914	J2000	13.925		1200	1	14	spec	1.0	

Target Table for Run 1: CT-1.5m-SVC/CHIRON

Obj ID	Object	α	δ	Epoch	Mag.	Filter	Exp. time	# of exp.	Lunar days	Sky	Seeing	Comment
126	CG1-026	7 11 1.622	-45 30 37.783	J2000	11.949		1200	1	14	spec	1.0	
127	CG1-027	7 13 35.996	-47 40 28.099	J2000	12.103		1200	1	14	spec	1.0	
128	CG1-028	7 13 45.179	-47 23 1.588	J2000	12.533		1200	1	14	spec	1.0	
129	CG1-029	7 15 6.742	-46 39 4.89	J2000	11.991		1200	1	14	spec	1.0	
130	CG1-030	7 16 3.373	-47 27 48.057	J2000	11.735		1200	1	14	spec	1.0	
131	CG1-031	7 16 12.568	-46 37 38.398	J2000	10.680		1200	1	14	spec	1.0	
132	CG1-032	7 17 6.777	-45 32 1.533	J2000	12.172		1200	1	14	spec	1.0	
133	CG1-033	7 17 9.696	-46 48 54.638	J2000	9.547		1200	1	14	spec	1.0	
134	CG1-034	7 17 9.938	-46 41 40.067	J2000	12.132		1200	1	14	spec	1.0	
135	CG1-035	7 17 21.553	-45 38 44.376	J2000	12.331		1200	1	14	spec	1.0	
136	CG1-036	7 24 38.236	-45 42 49.198	J2000	12.430		1200	1	14	spec	1.0	
137	CG1-037	7 26 29.825	-44 36 17.354	J2000	13.117		1200	1	14	spec	1.0	
138	CG1-038	7 26 48.85	-45 27 50.619	J2000	11.346		1200	1	14	spec	1.0	
139	CG1-039	7 31 13.022	-47 45 47.7	J2000	12.351		1200	1	14	spec	1.0	
201	CG4-001	7 31 21.856	-46 57 43.938	J2000	14.334		1200	1	14	spec	1.0	
202	CG4-002	7 31 29.638	-46 58 48.737	J2000	11.914		1200	1	14	spec	1.0	
203	CG4-003	7 31 44.122	-47 0 1.135	J2000	11.113		1200	1	14	spec	1.0	
331	nCG3-031	7 38 16.065	-46 6 20.326	J2000	11.649		1200	1	14	spec	1.0	
332	nCG3-032	7 40 48.405	-46 38 19.131	J2000	11.934		1200	1	14	spec	1.0	
333	nCG3-033	7 43 23.487	-49 22 8.845	J2000	10.880		1200	1	14	spec	1.0	
334	nCG3-034	7 47 36.977	-47 26 27.698	J2000	13.953		1200	1	14	spec	1.0	
335	nCG3-035	7 49 30.824	-47 52 4.557	J2000	11.739		1200	1	14	spec	1.0	
336	nCG3-036	7 49 45.704	-47 49 35.913	J2000	10.516		1200	1	14	spec	1.0	
337	nCG3-037	7 50 10.106	-47 20 32.583	J2000	13.436		1200	1	14	spec	1.0	
338	nCG3-038	7 50 29.119	-47 57 43.579	J2000	12.624		1200	1	14	spec	1.0	
339	nCG3-039	7 51 31.257	-47 18 47.121	J2000	12.463		1200	1	14	spec	1.0	
340	nCG3-040	7 51 48.709	-47 15 7.657	J2000	9.644		1200	1	14	spec	1.0	
341	nCG3-041	7 52 1.532	-48 50 8.024	J2000	11.914		1200	1	14	spec	1.0	
342	nCG3-042	7 53 22.151	-47 13 29.6	J2000	11.072		1200	1	14	spec	1.0	
343	nCG3-043	7 54 2.64	-48 21 36.465	J2000	12.082		1200	1	14	spec	1.0	
344	nCG3-044	7 54 14.819	-46 26 0.302	J2000	13.282		1200	1	14	spec	1.0	
345	nCG3-045	7 54 25.503	-46 51 13.443	J2000	13.195		1200	1	14	spec	1.0	
346	nCG3-046	7 57 9.978	-47 31 27.082	J2000	10.984		1200	1	14	spec	1.0	
347	nCG3-047	8 0 14.813	-47 46 49.023	J2000	9.424		1200	1	14	spec	1.0	
348	nCG3-048	8 3 26.768	-45 59 37.398	J2000	13.540		1200	1	14	spec	1.0	
410	nCG14-010	7 42 5.614	-48 40 17.305	J2000	11.302		1200	1	14	spec	1.0	
411	nCG14-011	7 43 13.18	-47 46 8.915	J2000	13.761		1200	1	14	spec	1.0	
412	nCG14-012	7 43 13.18	-47 46 8.915	J2000	13.761		1200	1	14	spec	1.0	
413	nCG14-013	7 45 44.72	-46 46 15.277	J2000	9.806		1200	1	14	spec	1.0	
414	nCG14-014	7 47 36.977	-47 26 27.698	J2000	13.953		1200	1	14	spec	1.0	
415	nCG14-015	7 47 36.977	-47 26 27.698	J2000	13.953		1200	1	14	spec	1.0	
416	nCG14-016	7 52 28.122	-48 23 15.707	J2000	9.499		1200	1	14	spec	1.0	
417	nCG14-017	7 55 46.204	-47 12 48.35	J2000	12.186		1200	1	14	spec	1.0	
418	nCG14-018	7 58 16.922	-49 14 10.993	J2000	9.827		1200	1	14	spec	1.0	
419	nCG14-019	8 6 44.388	-48 16 7.55	J2000	10.925		1200	1	14	spec	1.0	
514	GDC1-014	8 24 39.442	-52 15 9.175	J2000	13.240		1200	1	14	spec	1.0	
515	GDC1-015	8 25 2.394	-49 47 56.385	J2000	12.752		1200	1	14	spec	1.0	
516	GDC1-016	8 29 22.194	-50 50 36.934	J2000	12.803		1200	1	14	spec	1.0	
517	GDC1-017	8 30 16.395	-51 53 16.795	J2000	12.040		1200	1	14	spec	1.0	
518	GDC1-018	8 30 18.49	-51 1 34.481	J2000	12.617		1200	1	14	spec	1.0	

Target Table for Run 1: CT-1.5m-SVC/CHIRON

Obj ID	Object	α	δ	Epoch	Mag.	Filter	Exp. time	# of exp.	Lunar days	Sky	Seeing	Comment
519	GDC1-019	8 30 19.027	-51 1 31.569	J2000	11.814		1200	1	14	spec	1.0	
520	GDC1-020	8 32 8.812	-51 31 11.42	J2000	13.769		1200	1	14	spec	1.0	
521	GDC1-021	8 32 38.867	-52 26 45.052	J2000	12.722		1200	1	14	spec	1.0	
522	GDC1-022	8 35 16.281	-51 56 16.634	J2000	12.712		1200	1	14	spec	1.0	
523	GDC1-023	8 36 18.919	-52 32 3.871	J2000	11.545		1200	1	14	spec	1.0	
524	GDC1-024	8 37 39.254	-52 40 13.375	J2000	11.039		1200	1	14	spec	1.0	
712	nCG17-012	8 29 24.895	-50 39 48.333	J2000	12.002		1200	1	14	spec	1.0	
713	nCG17-013	8 29 47.461	-50 4 51.102	J2000	13.706		1200	1	14	spec	1.0	
714	nCG17-014	8 29 56.582	-51 11 45.559	J2000	13.243		1200	1	14	spec	1.0	
715	nCG17-015	8 32 46.412	-50 58 16.027	J2000	13.579		1200	1	14	spec	1.0	
716	nCG17-016	8 33 49.682	-51 42 59.397	J2000	11.624		1200	1	14	spec	1.0	
717	nCG17-017	8 34 24.233	-53 48 19.3	J2000	12.482		1200	1	14	spec	1.0	
718	nCG17-018	8 34 37.308	-50 24 50.867	J2000	13.481		1200	1	14	spec	1.0	
719	nCG17-019	8 35 15.266	-50 54 25.256	J2000	10.463		1200	1	14	spec	1.0	
720	nCG17-020	8 36 49.68	-54 7 55.372	J2000	11.423		1200	1	14	spec	1.0	
721	nCG17-021	8 37 38.635	-51 0 3.119	J2000	12.970		1200	1	14	spec	1.0	
722	nCG17-022	8 37 58.817	-51 48 21.755	J2000	13.580		1200	1	14	spec	1.0	
723	nCG17-023	8 38 54.625	-51 42 7.678	J2000	9.452		1200	1	14	spec	1.0	
724	nCG17-024	8 39 17.889	-53 17 5.522	J2000	9.212		1095	1	14	spec	1.0	
725	nCG17-025	8 39 50.238	-51 32 24.372	J2000	12.047		1200	1	14	spec	1.0	
726	nCG17-026	8 39 51.735	-51 55 7.066	J2000	11.870		1200	1	14	spec	1.0	
727	nCG17-027	8 39 51.865	-51 46 7.17	J2000	11.843		1200	1	14	spec	1.0	
728	nCG17-028	8 39 51.993	-51 55 17.401	J2000	12.501		1200	1	14	spec	1.0	
729	nCG17-029	8 40 29.78	-51 32 10.601	J2000	13.504		1200	1	14	spec	1.0	
730	nCG17-030	8 44 11.494	-49 43 40.469	J2000	13.302		1200	1	14	spec	1.0	
731	nCG17-031	8 44 29.059	-51 48 28.028	J2000	12.415		1200	1	14	spec	1.0	
732	nCG17-032	8 49 15.073	-51 2 24.213	J2000	9.857		1200	1	14	spec	1.0	
801	CG22-001	8 28 47.518	-34 29 29.906	J2000	12.695		1200	1	14	spec	1.0	

Observing Run Details for Run 2: SOAR/Goodman

Technical Description *Describe the observations to be made during this observing run. Justify the specific telescope, the number of nights, the instrument, and the lunar phase. List objects, coordinates, and magnitudes (or surface brightness, if appropriate) in the Target Tables section below (required for queue and Gemini runs).*

We will use the red camera to obtain spectra of ideally all 93 single stars with $14 < V < 16$ in all 5 young clusters, near CG 4, 3, 14, 30, and 22 (see Fig. 1, salmon squares). Single stars are simpler to analyze than binary stars, and young clusters are more likely to host stars with accretion disks, observable in Hα emission. If time is short, we will focus on the clusters near CG 4, 14, 30, and 22 (in Run 2 Target Table 2) and save the large cluster near CG 3 (in Run 2 Target Table 3) for later.

We will use the 0.45" single slit, 2100 l/mm grating, 1x1 binning, readout speed 344 kHz, and exposure time capped at 2 x 1200 s for $V > 14.3$ for sufficient resolution ∼10,000 and SNR 30 – 10. Because we are observing one star at a time, we will shorten the slit's region of interest to 2 arcminutes or less to save on readout time. We will use the fast acquisition camera GACAM to find our targets whenever possible, switching to pre-imaging only when a given target's crowded field requires. Having surveyed 2MASS images of the 89 targets previously acquired with CHIRON, we believe GACAM will suffice for most of our proposal's target acquisitions. We have calculated our Goodman time request based on 9/10 use of GACAM and 1/10 use of pre-imaging.

We will focus on the wavelength region 4500 – 8500 Å to mimic the satisfying range of CHIRON, which includes atomic lines for spectral type and continuum excess, Li I λ6708, Hα, and the telluric A-band at 7600 – 7630 Å for calibration of the wavelength solution. Because the red camera suffers from a second-order-caused blue leak redward of 6000 Å, we will take continuum excess measurements (tending to manifest as extra blue light) within the 4500 – 6000 Å region to dodge blue degeneracy.

Using the same setup described above, we will acquire spectra of 18 bright spectral standards (in Run 2 Target Table 1) matching our already-assembled CHIRON catalogue. We include a red star HD 191849 of spectral type M0V, useful for correcting the blue leak. We will take one spectrum of the red star using the same setup as the other stars, and one more spectrum of the red star using the 2nd order blocking filter. We have also, as aforementioned, already taken CHIRON spectra of these same standards. CHIRON does not suffer from the nefarious blue leak. Therefore, comparisons between the Goodman and CHIRON standard spectra could enable us to measure the Goodman blue leak as a function of wavelength and remove the leak accordingly.

Instrument Configuration

Filters: 2nd order blocking filter	Slit: 0.45"	Fiber cable: n/a
Grating/grism: 2100 l/mm	Multislit: no	Corrector: n/a
Order:	λ_{start}: 4500	Collimator: F = 1200.15 mm
Cross disperser:	λ_{end}: 8500	Atmos. disp. corr.: no

R.A. range of principal targets (hours): 7 to 9

Dec. range of principal targets (degrees): -55 to -34

Special Instrument Requirements *Describe briefly any special or non-standard usage of instrumentation.*

Target Table for Run 2: SOAR/Goodman

Obj ID	Object	α	δ	Epoch	Mag.	Filter	Exp. time	# of exp.	Lunar days	Sky	Seeing
000	B9V-HD4622	00 48 01.06	-21 43 21.1	J2000	5.570		8	1	14	spec	1.0
001	A1V-HD65900	08 01 13.90	+04 52 47.5	J2000	3.830		2	1	14	spec	1.0
002	A3V-HD96568	11 06 24.25	-64 50 23.8	J2000	6.381		18	1	14	spec	1.0
003	A4V-HD75171	08 44 29.96	-65 49 31.5	J2000	6.021		13	1	14	spec	1.0
004	A6V-HD39060	05 47 17.08	-51 03 59.3	J2000	3.860		2	1	14	spec	1.0
005	F1V-HD40136	05 56 24.28	-14 10 03.7	J2000	3.720		2	1	14	spec	1.0
006	F6V-HD38393	05 44 27.78	-22 26 54.1	J2000	3.600		1	1	14	spec	1.0
007	G0V-HD1388	00 17 58.86	-13 27 20.3	J2000	6.500		20	1	14	spec	1.0
008	G3V-HD59967	07 30 42.50	-37 20 21.6	J2000	6.490		20	1	14	spec	1.0
009	G8.5V-HD10700	01 44 04.08	-15 56 14.9	J2000	3.500		1	1	14	spec	1.0
010	K0V-HD26965	04 15 16.32	-7 39 10.3	J2000	4.430		3	1	14	spec	1.0
011	K2V-GJ144	03 32 55.85	-9 27 29.6	J2000	3.730		2	1	14	spec	1.0
012	K4V-GJ845A	22 03 21.64	-56 47 09.5	J2000	4.690		4	1	14	spec	1.0
013	K7V-GJ185	05 02 28.42	-21 15 23.8	J2000	8.320		107	1	14	spec	1.0
014	G7III-HD24160	03 49 27.25	-36 12 00.9	J2000	4.170		2	1	14	spec	1.0
015	K0III-HD201381	21 09 35.64	-11 22 18.1	J2000	4.520		3	1	14	spec	1.0
016	K2III-HD26846	04 14 23.69	-10 15 22.6	J2000	4.860		4	1	14	spec	1.0
017	M0V-HD191849	20 13 53.39	-45 09 50.5	J2000	7.966		77	1	14	spec	1.0
018	M0V-HD191849	20 13 53.39	-45 09 50.5	J2000	7.966	2nd order blocking filter	100	1	14	spec	1.0

Target Table for Run 2: SOAR/Goodman

Obj ID	Object	α	δ	Epoch	Mag.	Filter	Exp. time	# of exp.	Lunar days	Sky	Seeing	Comment
200	CG4-000	7 29 32.903	-46 11 3.618	J2000	14.318		1200	2	14	spec	1.0	
201	CG4-001	7 31 36.683	-47 0 13.217	J2000	15.482		1200	2	14	spec	1.0	
202	CG4-002	7 31 53.832	-47 32 25.139	J2000	15.859		1200	2	14	spec	1.0	
203	CG4-003	7 32 0.781	-46 58 48.016	J2000	15.888		1200	2	14	spec	1.0	
204	CG4-004	7 33 26.864	-46 48 42.562	J2000	14.190		1072	2	14	spec	1.0	
400	nCG14-000	7 40 3.424	-48 29 56.969	J2000	15.464		1200	2	14	spec	1.0	
401	nCG14-001	7 44 46.745	-48 42 43.606	J2000	15.447		1200	2	14	spec	1.0	
402	nCG14-002	7 46 4.172	-49 21 12.582	J2000	15.970		1200	2	14	spec	1.0	
403	nCG14-003	7 48 1.208	-49 10 2.236	J2000	14.203		1085	2	14	spec	1.0	
404	nCG14-004	7 48 10.922	-47 53 47.339	J2000	15.466		1200	2	14	spec	1.0	
405	nCG14-005	7 48 51.325	-48 22 44.056	J2000	15.355		1200	2	14	spec	1.0	
406	nCG14-006	7 51 41.652	-48 3 28.804	J2000	14.115		1000	2	14	spec	1.0	
407	nCG14-007	7 52 27.674	-49 30 6.82	J2000	14.709		1200	2	14	spec	1.0	
408	nCG14-008	7 52 27.982	-49 30 8.917	J2000	15.122		1200	2	14	spec	1.0	
409	nCG14-009	7 53 16.777	-49 10 35.261	J2000	14.945		1200	2	14	spec	1.0	
410	nCG14-010	7 53 54.617	-48 12 29.64	J2000	15.350		1200	2	14	spec	1.0	
411	nCG14-011	7 58 7.114	-48 23 21.847	J2000	14.741		1200	2	14	spec	1.0	
412	nCG14-012	7 58 26.25	-48 1 50.445	J2000	15.671		1200	2	14	spec	1.0	
413	nCG14-013	7 58 32.851	-49 16 12.822	J2000	15.403		1200	2	14	spec	1.0	
414	nCG14-014	7 58 48.957	-49 11 46.746	J2000	14.976		1200	2	14	spec	1.0	
415	nCG14-015	7 59 8.903	-49 14 49.528	J2000	15.909		1200	2	14	spec	1.0	
416	nCG14-016	7 59 9.333	-49 50 54.89	J2000	14.983		1200	2	14	spec	1.0	
417	nCG14-017	8 0 26.746	-47 7 37.19	J2000	14.592		1200	2	14	spec	1.0	
418	nCG14-018	8 0 48.617	-48 57 32.182	J2000	15.186		1200	2	14	spec	1.0	
419	nCG14-019	8 1 4.703	-47 45 23.904	J2000	15.596		1200	2	14	spec	1.0	
420	nCG14-020	8 2 28.926	-48 54 40.219	J2000	15.151		1200	2	14	spec	1.0	
421	nCG14-021	8 2 37.301	-46 37 10.24	J2000	14.392		1200	2	14	spec	1.0	
422	nCG14-022	8 4 34.314	-49 31 45.251	J2000	14.504		1200	2	14	spec	1.0	
423	nCG14-023	8 6 34.494	-47 5 18.521	J2000	15.273		1200	2	14	spec	1.0	
424	nCG14-024	8 9 6.438	-48 43 28.275	J2000	15.636		1200	2	14	spec	1.0	
425	nCG14-025	8 10 47.369	-50 13 58.051	J2000	15.943		1200	2	14	spec	1.0	
426	nCG14-026	8 12 23.398	-49 13 53.043	J2000	15.877		1200	2	14	spec	1.0	
600	CG30-000	8 8 57.163	-36 45 11.091	J2000	15.832		1200	2	14	spec	1.0	
601	CG30-001	8 10 40.171	-36 38 51.611	J2000	15.416		1200	2	14	spec	1.0	
800	CG22-000	8 26 19.325	-34 38 26.796	J2000	14.027		923	2	14	spec	1.0	
801	CG22-001	8 26 29.418	-34 35 8.152	J2000	15.830		1200	2	14	spec	1.0	
802	CG22-002	8 26 30.404	-34 30 37.279	J2000	15.483		1200	2	14	spec	1.0	
803	CG22-003	8 27 20.222	-34 27 49.556	J2000	14.697		1200	2	14	spec	1.0	
804	CG22-004	8 27 34.641	-35 5 55.776	J2000	15.500		1200	2	14	spec	1.0	
805	CG22-005	8 27 50.933	-35 6 57.58	J2000	15.934		1200	2	14	spec	1.0	
806	CG22-006	8 27 56.447	-34 54 52.872	J2000	14.031		926	2	14	spec	1.0	
807	CG22-007	8 28 14.608	-34 58 1.723	J2000	15.194		1200	2	14	spec	1.0	
808	CG22-008	8 28 19.667	-33 54 36.631	J2000	15.885		1200	2	14	spec	1.0	
809	CG22-009	8 28 41.031	-34 31 34.148	J2000	14.014		912	2	14	spec	1.0	
810	CG22-010	8 28 55.795	-34 24 9.867	J2000	15.995		1200	2	14	spec	1.0	

Target Table for Run 2: SOAR/Goodman

Obj ID	Object	α	δ	Epoch	Mag.	Filter	Exp. time	# of exp.	Lunar days	Sky	Seeing	Comment
300	nCG3-000	7 36 19.189	-45 0 43.469	J2000	15.945		1200	2	14	spec	1.0	
301	nCG3-001	7 37 38.316	-45 9 51.5	J2000	15.484		1200	2	14	spec	1.0	
302	nCG3-002	7 40 30.77	-45 26 2.885	J2000	15.670		1200	2	14	spec	1.0	
303	nCG3-003	7 40 51.098	-45 14 36.404	J2000	14.542		1200	2	14	spec	1.0	
304	nCG3-004	7 41 1.825	-47 42 50.297	J2000	15.275		1200	2	14	spec	1.0	
305	nCG3-005	7 42 46.213	-48 1 1.681	J2000	14.324		1200	2	14	spec	1.0	
306	nCG3-006	7 43 1.029	-47 18 15.583	J2000	15.781		1200	2	14	spec	1.0	
307	nCG3-007	7 44 2.944	-47 22 51.482	J2000	14.027		923	2	14	spec	1.0	
308	nCG3-008	7 44 4.396	-46 47 40.094	J2000	15.227		1200	2	14	spec	1.0	
309	nCG3-009	7 44 8.206	-47 43 33.667	J2000	15.779		1200	2	14	spec	1.0	
310	nCG3-010	7 44 25.64	-46 44 14.735	J2000	15.945		1200	2	14	spec	1.0	
311	nCG3-011	7 44 46.745	-48 42 43.606	J2000	15.447		1200	2	14	spec	1.0	
312	nCG3-012	7 44 55.144	-45 42 14.514	J2000	14.622		1200	2	14	spec	1.0	
313	nCG3-013	7 45 7.327	-46 7 12.256	J2000	15.178		1200	2	14	spec	1.0	
314	nCG3-014	7 45 10.504	-48 17 41.603	J2000	15.470		1200	2	14	spec	1.0	
315	nCG3-015	7 45 27.591	-45 39 30.25	J2000	15.544		1200	2	14	spec	1.0	
316	nCG3-016	7 45 54.209	-48 12 25.218	J2000	14.364		1200	2	14	spec	1.0	
317	nCG3-017	7 46 56.143	-46 33 23.896	J2000	15.093		1200	2	14	spec	1.0	
318	nCG3-018	7 46 58.816	-48 51 6.151	J2000	15.941		1200	2	14	spec	1.0	
319	nCG3-019	7 47 26.175	-46 53 53.892	J2000	14.838		1200	2	14	spec	1.0	
320	nCG3-020	7 48 0.091	-46 15 46.269	J2000	14.827		1200	2	14	spec	1.0	
321	nCG3-021	7 48 23.677	-45 51 37.321	J2000	15.519		1200	2	14	spec	1.0	
322	nCG3-022	7 48 56.954	-45 48 10.114	J2000	15.426		1200	2	14	spec	1.0	
323	nCG3-023	7 49 5.319	-46 15 51.646	J2000	14.883		1200	2	14	spec	1.0	
324	nCG3-024	7 49 13.991	-46 22 12.271	J2000	14.646		1200	2	14	spec	1.0	
325	nCG3-025	7 49 22.398	-46 20 32.324	J2000	15.232		1200	2	14	spec	1.0	
326	nCG3-026	7 49 30.236	-46 19 38.528	J2000	15.507		1200	2	14	spec	1.0	
327	nCG3-027	7 49 34.842	-46 20 20.438	J2000	14.435		1200	2	14	spec	1.0	
328	nCG3-028	7 49 36.691	-45 48 43.898	J2000	14.677		1200	2	14	spec	1.0	
329	nCG3-029	7 49 42.56	-46 12 26.087	J2000	14.369		1200	2	14	spec	1.0	
330	nCG3-030	7 49 51.863	-46 19 45.58	J2000	15.558		1200	2	14	spec	1.0	
331	nCG3-031	7 50 0.774	-45 20 8.534	J2000	15.845		1200	2	14	spec	1.0	
332	nCG3-032	7 50 2.632	-45 31 10.654	J2000	14.545		1200	2	14	spec	1.0	
333	nCG3-033	7 51 18.702	-46 2 33.748	J2000	14.531		1200	2	14	spec	1.0	
334	nCG3-034	7 51 33.39	-45 37 20.577	J2000	15.172		1200	2	14	spec	1.0	
335	nCG3-035	7 51 53.867	-48 42 46.16	J2000	15.682		1200	2	14	spec	1.0	
336	nCG3-036	7 52 29.402	-46 34 56.975	J2000	14.654		1200	2	14	spec	1.0	
337	nCG3-037	7 52 34.338	-47 45 47.338	J2000	15.988		1200	2	14	spec	1.0	
338	nCG3-038	7 52 53.938	-47 27 37.592	J2000	15.238		1200	2	14	spec	1.0	
339	nCG3-039	7 54 47.324	-46 47 24.285	J2000	15.468		1200	2	14	spec	1.0	
340	nCG3-040	7 54 48.991	-46 50 33.283	J2000	15.964		1200	2	14	spec	1.0	
341	nCG3-041	7 55 19.354	-46 30 45.164	J2000	15.460		1200	2	14	spec	1.0	
342	nCG3-042	7 56 5.147	-47 7 54.82	J2000	15.330		1200	2	14	spec	1.0	
343	nCG3-043	7 56 8.42	-46 40 50.879	J2000	14.254		1137	2	14	spec	1.0	
344	nCG3-044	7 57 4.532	-46 35 42.273	J2000	14.920		1200	2	14	spec	1.0	
345	nCG3-045	7 57 23.295	-47 37 53.795	J2000	15.530		1200	2	14	spec	1.0	
346	nCG3-046	7 58 8.368	-44 35 18.392	J2000	15.175		1200	2	14	spec	1.0	
347	nCG3-047	7 58 32.851	-49 16 12.822	J2000	15.403		1200	2	14	spec	1.0	