OBSERVING REQUEST
University of Arizona Observatories

Year: 2015 **Term:** Sep–Dec **Proposal type:** short-term⋆

Companions to Nearby M-dwarfs: A Large-Scale Survey of Multiplicity Across the Stellar/Substellar Boundary

P.I.: Kimberly Ward-Duong⋆ (ASU; *kwardduo@asu.edu*; 928-202-8562)

CoI(s): Jenny Patience (ASU), Don McCarthy (SO), Craig Kulesa (SO), Robert De Rosa (UC Berkeley), Joanna Bulger (ASU), Abhijith Rajan⋆ (ASU), Simon Goodwin (University of Sheffield), Richard Parker (Liverpool John Moores Univ.)

Abstract of Scientific Justification

We propose to obtain MMT ARIES imaging to complete a large-scale survey of the 245 M-dwarfs within 15 pc as defined from *Hipparcos* parallaxes. All of the stars from our volume-limited survey have archival widefield imaging covering companion separations from ∼300 to 10^4 AU, but 46 systems observable in the 2015C trimester lack the multi-epoch AO imaging necessary to cover the ∼1 to 300 AU range, and continuous separation coverage is essential to determine higher-order stellar and substellar multiplicity. Of these systems, 8 systems require second epoch confirmation imaging of candidate substellar companions, while the remaining 38 systems have no previous AO observations and constitute a first epoch search for new candidates. With the proposed first and second-epoch observations of the remaining systems from our sample, we will characterize the frequency of stellar and substellar companions to M-dwarfs down to ∼30-40 Jupiter masses. The requested AO observations combined with existing widefield imaging will allow us to determine M-dwarf companion frequencies over an unprecedented separation range of ∼1 to 10^4 AU, thereby providing the most comprehensive companion statistics to-date across the stellar/substellar boundary for low-mass stars. Given the intrinsic low luminosities and masses of M-dwarfs, the abundant nearby M-dwarf population is also of particular interest for upcoming exoplanet surveys and missions, such as *TESS*, which aim to discover Exo-Earths. The proposed ARIES observations, which will enable a census of local M-dwarf stellar and substellar systems, will provide important constraints upon our nearest, lowest-mass neighboring stellar systems.

Summary of observing runs requested for this project

Run	Telescope	Cage	Instrument	PI	AO	Nights	Moon	Scheduling Optimal	Scheduling Acceptable	Sharing Poss.	Sharing Adv.
1	MMT	f/15	ARIES	*	*	2.5	bright	Oct–Nov	Aug–Dec	yes	yes

Scheduling constraints and unusable dates *(up to 4 lines)*: As the proposed targets span a range of RA values, these targets may be scheduled any time during the 2015B semester, although bright time in October-November would be optimal to avoid anticipated instrument scheduling conflicts.

no text past this line

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	Example: HIP12097	02:35:53.30	+20:13:11.57	V=10.63, K=6.33, Stellar Target
2	(Please refer to the end of the proposal for the complete target list)			

Approval for Instrument Use from PI: Please see attached approval e-mail from Don McCarthy.

Graduate students *(provide the following information for **each** student named as PI or CoI on the cover page. Have the advisor's signature(s) appear on **all** submitted copies)*

Student's Name	Advisor's Name	Advisor's Signature	2nd-yr	Thesis
Kimberly Ward-Duong	Jenny Patience		no	yes
Abhijith Rajan	Jenny Patience		no	no

Scientific Justification

Scientific Context: M-dwarfs comprise the large majority of the nearest stars (e.g. Reid & Gizis 1997), and low mass stars also dominate the nearest star-forming regions, with ∼50% of Taurus members having spectral types later than M3 (Luhman et al. 2010). The abundance of these stars highlights the importance of constructing a comprehensive view of the full diversity of M-dwarf stellar and substellar systems. Due to their low masses and luminosities, M-dwarfs also represent a particularly attractive population of stars around which to search for exoplanets and brown dwarfs. The study of their substellar companions therefore represents an important link between characterizing stellar multiplicity for M-star primaries (e.g. Fischer & Marcy 1992) and efforts to investigate their exoplanet systems (e.g. Montet et al. 2014). Despite the observed "brown dwarf desert" in companion frequency at close (∼1 AU) separations (Marcy & Butler 2000), studies have indicated that wide orbit substellar companions may be more common (Gizis et al. 2001). Detections of M-dwarf planets (Dressing & Charbonneau 2013) indicate important distinctions between the exoplanet and brown dwarf populations, however, no comprehensive survey exists to definitively constrain the frequency, separations, and mass ratios of both substellar and stellar companions to M-dwarfs over a wide range of separations.

The M-dwarfs in Multiples (MinMs) Survey: Our sample consists of M-dwarfs with parallax measurements placing them within 15 pc, such that AO data cover separations from ∼1 to 300 AU. We derived this sample from the SIMBAD database by selecting on parallax measurements obtained with the *Hipparcos* satellite (Van Leeuwen 2007). The catalog was filtered to obtain only those stars with a parallax $\pi > 66$ mas and color criteria corresponding to spectral types within the M-dwarf range M0-M9. This selection process produced a sample containing 245 M-dwarfs, and for 196 of these targets, we analyzed archival high-resolution and adaptive optics imaging from the VLT, HST, Subaru, and CFHT archives, as well as new AO observations from the MMT. The AO companion data produced a number of interesting substellar candidate companions, including a previously detected brown dwarf companion (Gliese 229B; Nakajima et al. 1995), as shown in Figure 1. We have also searched archival digitized photographic plates for the full 245-star sample to detect common proper motion companions at separations from ∼300-10^4 AU to determine the most comprehensive population statistics on binary fraction, mass ratio distribution, and binary separation distribution for companions to M-stars; the stellar separation distribution is shown in Figure 2 (Ward-Duong et al. 2015, *in press*). In order to determine the brown dwarf frequency from the 196-star AO observed sample, we require 1) confirmation AO imaging of the remaining candidate systems in our volume-limited sample, and 2) new observations of the sample targets which lack any previous AO observations to detect any additional unknown companions. **With well-defined distance measurements, the combination of wide and close searches for brown dwarf companions will provide an unprecedented census of M-dwarf companions over the widest range of separations.** With MMT/ARIES, we propose to continue a deep imaging search for stellar and substellar companions to 46 M-dwarf systems, including 8 second-epoch observations required to test the physical association of new substellar companion candidates to M-dwarf stars. The targets shown in Figure 1 represent some of the substellar candidate companions detected within our volume-limited survey of 245 field M-dwarfs, and have estimated masses within the ∼35-75 Jupiter mass range, if associated.

Previous Work: We are pursuing a set of coordinated observational and theoretical programs to measure, compare, and interpret the stellar and substellar binary properties of star-forming regions and the field. In the first two papers (King et al. 2012a, 2012b), we applied uniform mass ratio and separation cuts to construct comparable binary statistics for five star-forming regions (Taurus, Chameleon I, Ophiuchus, IC 348, and the Orion Nebula Cluster) and used N-body simulations to search for a set of initial conditions that could reproduce the density, morphology, and binary fractions of all five clusters. The results show that, if star-formation is universal, then the initial conditions must be clumpy with a high (∼70%) binary fraction (King et al. 2012a), and simulations also predict a large percentage of triple and higher-order systems. Since most of the star-forming regions consisted of M-stars, one implication is a high initial binary fraction for the youngest M-stars, underscoring the need for a well-characterized M-star field sample for comparison. While large-scale stellar population statistics have been studied for G-dwarf binaries (Duquennoy & Mayor 1991, Raghavan et al. 2010) and A-type stars (the Volume-limited A-STar survey, De Rosa et al. 2011, 2012, 2014), existing M-star binary surveys with comprehensive separation coverage have been far more

limited in their statistics. The Fischer & Marcy (1992) study involved a limited sample with few stars observed over the full range of separations and mass ratios; the Bergfors et al. (2010) study included a mixed collection of distances (often based on photometry) and an activity-based selection criterion; and the Jansen et al. (2012) AstraLux survey, while covering a larger sample of $\sim$700 K and M stars, did not probe the most widely-separated systems and therefore could not fully characterize higher-order multiplicity of the lowest-mass stars. Similarly, benchmark studies have been made for substellar companions to solar-type stars (e.g. Metchev et al. 2007), but existing M-star planet searches have detected only a limited number of brown dwarfs (e.g. the PALMS survey; Bowler et al. 2012a, 2012b). By contrasting a sample of field stars with star forming regions, it is possible to compare primordial binary populations with the population of field binaries. With our recent publication on nearby M-dwarf stellar multiplicity (Ward-Duong et al. 2015), **our proposed measurements will fully complete the census to a well-defined M-dwarf sample with an extension to substellar companions, providing this much-needed, directly comparable field study.**

Proposed Targets: From our archival search, we found that of the 60 targets lacking archival AO observations, a significant number of previously unobserved M-dwarf systems are visible from the North (38 targets). These stars form the search sample of our proposed observations, all of which are observable during the 2015C trimester. Existing archival imaging also produced 30 new stellar and substellar candidates, and with an approved VLT/NACO program (PI: De Rosa), we obtained confirmation imaging of nine new Southern stellar candidates – two of which were confirmed to share common proper motion – and four of the Southern substellar candidates detected in our sample, which we are currently incorporating into our population analysis. For the remaining Northern substellar candidates, we have searched all public archives with high angular resolution data (VLT, Keck, HST, Gemini, Subaru, and CFHT), and found that the remaining 19 substellar candidates lack any available second-epoch data needed to confirm physical association, and that 8 of these 19 targets are visible from the MMT in the September – December term of 2015. These 8 stars form the confirmation sample of our proposed observations. Imaging of search sample will uncover any previously unknown close stellar and substellar companions, and will provide important measurements of host binarity for upcoming M-dwarf planet searches. By identifying new candidates in the remainder of our sample and confirming or rejecting identified candidates, we will measure the frequency of substellar companions, providing the most complete study of low-mass multiplicity across the stellar/substellar boundary. **The results of the proposed observations will provide definitive constraints upon the hierarchical nature of M-dwarf systems and how their architectures relate to star, brown dwarf, and planet formation.**

References

Bergfors et al. 2010, A&A, 520, 54
Bowler et al. 2012b, ApJ, 756, 69
De Rosa et al. 2012, MNRAS, 422, 2765
De Rosa et al. 2014, MNRAS, 437, 1216
Duquennoy & Mayor 1991, A&A, 248, 485
Fischer & Marcy 1992, ApJ, 396, 178
Gizis et al. 2001, ApJ, 551, 165
King et al. 2012a, MNRAS, 421, 2025
King et al. 2012b, MNRAS, 427, 2636
Luhman et al. 2010, ApJ, 720, 178
Marcy & Butler 2000, PASP, 112, 137
Metchev et al. 2007, ApJS, 181, 62
Montet et al. 2014, ApJ, 781, 28
Patience et al. 2002, ApJ, 581, 654
Raghavan et al. 2010, ApJS, 190, 1
Reid & Gizis 1997, AJ, 114, 1992
Van Leeuwen 2007, A&A, 474, 653
Ward-Duong et al. 2015, MNRAS, *in press*.

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)***

We propose to use the ARIES instrument in conjunction with the MMT AO system to conduct a search for new companions and confirmation imaging of companion candidates to nearby M-dwarfs. We will obtain diffraction-limited imaging of 46 nearby M-dwarf systems – 8 second-epoch systems with candidate brown dwarf companions, and 38 first-epoch systems without previous AO imaging – to complete our large, volume-limited survey of nearby low-mass stars. From the 245-star survey sample, 8 systems within the 196-star sample with previous AO observations have candidate substellar companions. These require second epoch observations, which will allow us to confirm or reject common proper motion and therefore physical association. With the proposed second-epoch observations, it will be possible to eliminate contamination from chance superpositions of unassociated pairs within the final statistics. Due to the extremely high proper motion of the sample targets ($0\farcs5$/year for a typical target, i.e. $1''$-$5''$ between the discovery epochs and proposed observations), second epoch MMT/ARIES observations will ensure unambiguous confirmation of resolved companion candidates. Measurements of separations and magnitude differences will allow us to accurately constrain orbital characteristics and mass ratios of these systems. The 8 brown dwarf candidates span a range of angular separations (between $\sim 1''$ and $8''$) and (if associated) absolute K-band magnitudes between M_K = 10.2 and M_K = 17.4, corresponding to companions with substellar masses.

For the 38-target search component of this proposal, we anticipate detection of $\sim$7 or 8 new substellar candidates given the yield from our previous search, and we will perform similar follow-up common proper motion imaging to confirm any detected candidates. At a median distance of 7 pc, the field of view of the ARIES instrument with the f/15 camera ($40''$) corresponds to a companion search space of $\sim$1 to $\sim$300 AU. Given the span in K-band magnitudes of the targets within the sample, the time required on each target will be tailored to ensure that substellar companions beyond the bottom of the Main Sequence are detectable. For the faintest field late-type M-dwarfs, only very short exposures will be required to reach beyond the Main Sequence, with a total integration time of only $\sim$2 minutes. For the brightest targets, a greater level of contrast is required to ensure sensitivity to the faintest substellar companions, increasing the time required on each target to approximately 15 minutes. Given the limiting K-band magnitude of ARIES of 22 mag in 60 minutes ($M_K \sim 19$ in 15 minutes), this corresponds to a 10σ detection of a 5 Gyr, 30 Jupiter mass brown dwarf at approximately 1-$2''$ separation in 15 minutes, based on contrast curves compiled from previous deep MMT/ARIES imaging. Including the instrument and telescope overheads for acquiring each target and obtaining a series of images (including two wavelengths for high probability associated companions), an average of 3 targets per hour will be observed.

Each target will be dithered across the detector to remove cosmetic defects, and to increase the area around the target searched for companions. This dither pattern will be selected to ensure that the proposed observations will overlap with existing *2MASS* observations, allowing for a complete characterization of the frequency of substellar companions to nearby M-dwarfs over the full range of companion separations. For the brightest targets, it becomes necessary to saturate the detector to ensure sensitivity to fainter companions below the bottom of the Main Sequence, and so a series of unsaturated exposures will be taken first to calibrate photometry of the saturated image. As the targets all have well-measured and high proper motions, it will be possible to confirm or reject any wide ($>5''$-$10''$, depending on target brightness) companion candidates based on comparison with archival *2MASS* images. For any companions that show common proper motion over the time baseline of *2MASS* and MMT images, we will obtain colors to further characterize the spectral type of the companion. For targets with close companions only clearly resolved with AO, the probability of being a background object will be estimated from *2MASS* source counts in the same part of the sky so that the single epoch measurements can be published, although follow-up measurements will be required to confirm candidate substellar companions. In addition to science imaging, we will obtain unsaturated exposures of several calibration binaries (e.g. Trapezium) to determine any distortion of the plate-scale across the detector, and the angle of North. Overall, given previous observations at the MMT and with other AO systems, we request 2.5 nights of observing time with ARIES, allowing for acquisition, instrument overheads, and observations of calibration targets.

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)***

1 – UAO Telescope Time

We were previously awarded 4.0 nights for this project from the UAO TAC for the 2014C trimester (UAO-S39), three of which were completely weathered out, and an additional night yielded 4 targets from the total requested sample of 60. An additional 2.0 nights were awarded in the 2015A trimester (UAO-S239), which yielded observations of 14 targets. The proposed observations requesting 2.5 nights for the 2015C trimester for the remaining 46 objects will allow us to confirm the 8 detected candidates and ideally complete the remaining Northern targets requested in 2014C, and a final run in 2016A would provide complete imaging of the unfinished RA distribution from 2015A.

2 – non-UAO Telescope Time

A related AO imaging program targeting brown dwarf companions to Southern M-dwarfs was submitted to ESO in the recent call for proposals (Period 96), which would complement the previously-allocated and proposed MMT Northern observations and complete the full-sky survey. We were previously allocated $\sim$15 hours of NACO time in Period 91 for follow-up observations of substellar and stellar candidate companions to nearby Southern M-dwarfs.

3 – Collaborations

Patience and her group are involved in several large survey programs – the **MinMs** (M-dwarfs in Multiple Systems) snapshot survey, the **VAST** (Volume-limited A-STar) survey, the **TBOSS** ("Taurus Boundary of Stellar/Substellar") collaboration, the **BAM** (Brown dwarf Atmosphere Monitoring) Project, and the **IDPS** (International Deep Planet Search) current AO system survey. Patience is the PI of the VAST survey which combined AO telescope access across a partnership of $\sim$10 collaborators to observe $\sim$250 A-stars. Patience is a co-I of the IDPS survey, which targets $\sim$250 young M-B stars, with primary responsibilities related to the B/A-star sample. Patience is a co-I of the BAM program that was extended to observe fainter brown dwarfs at the MMT. Publications and papers in progress from these surveys are listed below. Patience, De Rosa, Rajan, and Ward-Duong are Co-Is of the recently initiated **LEECH** LBT survey. Patience, De Rosa, Bulger, Rajan, and Ward-Duong are also members of the **GPI Exoplanet Survey** team to search for imaged planets in the North and South, and the Patience group has contributed to defining the target sets for both programs and some early observations with both LBT and Magellan instruments and GPI.

The MinMs and VAST publications thus far are student/postdoc-led: Ward-Duong et al. 2015 [**Stellar companions to M-dwarfs**], De Rosa et al. 2011 [**X-ray A-stars**], De Rosa et al. 2012 [**A-star orbits**], De Rosa et al. 2014, [**A-star binary statistics**], De Rosa et al. 2014 [**A-star brown dwarf detection**], Patience et al. 2015, in prep [**A-star debris disk binaries**], Schneider et al. 2015, in prep [**A-star binary age estimates**]. The TBOSS publications thus far are postdoc-led: Bulger et al. 2014 [**Herschel Disk Study**], Bulger et al. 2013 [**Submm Obs. of Debris Disks**] . The BAM publications thus far are student-led: Rajan et al. 2015 [**TY pilot study**], Wilson, Rajan, & Patience 2014 [**LT large scale survey**]. The IDPS A-star subset has been published by a postdoc working with Patience: Vigan et al. 2012 [**IDPS A-star initial results**].

Previous Use of Steward Facilities *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**)*

Companion Search - Allocations and Papers:
LBT: 2015A-UAO LBT low mass Taurus companion search - *PI: Patience (1.5 nights)* - 60% useful.
Magellan: 2014B-UAO - MagAO GPI target companion search - *PI: Ward-Duong (2 nights)* - 100% useful, **2013B-UAO - FourStar GPI target companion search** - *PI: Patience (2 nights)* - not useful.
MMT: 2015A-UAO-S236 - ARIES B-star companion search - *PI: Patience (3 nights)* - 15% useful, **2015A-UAO-S239 - ARIES M-star companion search** - *PI: Ward-Duong (2 nights)* - 60% useful, **2014B-UAO-S39 - ARIES M-star comp. search** - *PI: Ward-Duong (4 nights)* - 20% useful, **2013A-UAO-S2 - ARIES A-star companion follow-up** - *PI: De Rosa (4 half-nights)* - 50% useful, **2013B-UAO-S2 - ARIES A-star comp. follow-up** - *PI: De Rosa (1 night)* - 75% useful.

⋆ **Patience et al. 2014**, *The TBOSS (Taurus Boundary of Stellar/Substellar) Survey of Disk Properties*, 2014 IAUS, 299, 224 - Sample for follow-up projects, including LBT proposal.
⋆ **Bulger et al. 2014**, *The Taurus Boundary of Stellar/Substellar (TBOSS) Survey I: far-IR disk emission measured with Herschel*, A&A, 570, 29 - Sample for follow-up projects, including LBT proposal.
⋆ **Skemer et al. 2014** *LEECH: A 100 Night Exoplanet Imaging Survey at the LBT*, 2014 IAUS, 299, 70.
⋆ **Ward-Duong et al. 2015**, *The M-dwarfs in Multiples (MinMs) survey - I. Stellar multiplicity among low-mass stars within 15 pc*, MNRAS, in press - Includes MMT data.

Companion Characterization - Allocations and Papers:
LBT: 2013A - Thermal-IR substellar companion measurements: - *PI: Patience (1 night)* - 50% useful.
MMT: 2015A-UAO-S240 - ARIES substellar spec. characterization - *PI: Rajan (1 night)* - 80% useful, **2013C-UAO-S11 - ARIES substellar spec. characterization** - *PI: Ward-Duong (2 nights)* - 0% useful, **2014A-UAO-S1 - ARIES substellar spec. characterization** - *PI: De Rosa (4 nights)* - 25% useful.

• **De Rosa et al. 2014**, *Debris Disks and Multiplicity within the 75pc Volume-limited A-Star (VAST) Survey* 2014 IAUS, 299, 334 - Includes MMT data.
• **De Rosa et al. 2014**, *The VAST survey - IV. A wide brown dwarf companion to the A3V star ζ Delphini*, MNRAS, 445, 3694 - Characterization most similar to MMT proposal, includes MMT data.
• **Maire et al. 2015**, *The LEECH Exoplanet Imaging Survey. Further constraints on the planet architecture HR 8799 system*, A&A, in press.
• **De Rosa et al. 2015**, *The VAST survey - V. Confirmation observations of low-mass companions to nearby A-type stars*, MNRAS - Analysis of MMT data complete, paper in progress.

Brown dwarf Atmosphere Monitoring - Allocations and Papers:
MMT: 2012A-UAO-S3 - SWIRC brown dwarf (BD) variability monitoring - *PI: Patience (2 nights)* - 75% useful, **2013A-UAO-S99 - SWIRC BD variability monitoring** - *PI: Rajan (2 nights)* - 0% useful.

• **Rajan et al. 2014**, *Searching for Photometric Variability across the L, T & Y Dwarf Sequence*, 2014 IAUS, 299, 301 - Includes MMT data.
• **Wilson, Rajan, and Patience 2014**, *The Brown-dwarf Atmosphere Monitoring (BAM) Project I: Multi-epoch monitoring of extremely cool brown dwarfs*, A&A, 566, 111 - The paper established the code and observing practices for all current and future BAM projects, including the MMT proposal.
• **Rajan et al. 2015**, *The Brown-dwarf Atmosphere Monitoring (BAM) Project II: Multi-epoch monitoring of extremely cool brown dwarfs*, MNRAS, 448, 3775 - Includes MMT data.

Debris disks and evolutionary analysis - Allocations and Papers:
MMT: 2015A-UAO-S291 - Evolutionary Analysis of Nearby Debris Disks - *PI: Patience (2 nights)* - 100% (estimated from preliminary data reduction).

• **Bulger et al. 2013**, *Submillimeter observations of IRAS and WISE debris disk candidates*, A&A, 556, 119 - Debris disk identification project that includes MMT data.

Kimberly Ward-Duong <kwardduo@asu.edu>

AZ proposal PI notes

Don McCarthy <dwmccarthy@gmail.com> Wed, Apr 1, 2015 at 12:02 AM
To: Jenny Patience <jpatienc@asu.edu>
Cc: "jennifer.patience@asu.edu Patience" <jennifer.patience@asu.edu>, Kimberly Ward-Duong <kwardduo@asu.edu>, Craig Kulesa <ckulesa@email.arizona.edu>

I approve these ASU requests to use ARIES with MMT adaptive optics. A bright time observing run at the end of October is preferred to avoid known conflicts.

On Tue, Mar 31, 2015 at 9:43 PM, Jenny Patience <jpatienc@asu.edu> wrote:

> Hi, Don. Yes, MMT AO with ARIES. Thanks and sorry this is near the deadline.
>
> -- Jenny
>
> On 31 Mar 2015, at 21:36, Don McCarthy wrote:
>
> > Jenny, do you mean ARIES in Oct/Nov/Dec?
> >
> > Don
> >
> > On Tue, Mar 31, 2015 at 9:09 PM, Jenny Patience <jpatienc@asu.edu> wrote:
> >
> > > Hi, All. My students and I are planning on submitting several AZ telescope proposals and I need to ask if you could send the PI notes to attach. If you could send them to both me and Kim (copied on this email), that would be ideal, since Kim and I both have flights to Chile tomorrow, though her flight is a bit later.
> > >
> > > The proposals are continuations of existing programs, and we will send updated proposals if you would like the final version tomorrow (they are all being finished up tonight).
> > >
> > > LBT AO imaging:
> > > Finish the Taurus project with remaining observations and follow-up of some of the new companions. Quick synopsis: a number of new detections, mostly at the very close separations LBT probes, and some indicate the ALMA disks are circumbinary.
> > >
> > > MagAO imaging:
> > > Continue project w/Katie to observe GPI targets. Quick synopsis: two new candidate substellar companions.
> > >
> > > MMT AO imaging:
> > > 1) New observations of unobserved M's as part of MinMs survey and follow-up of candidate substellar companions. Quick synopsis: 1st MinMs binary survey paper published, hoping to confirm substellar

candidates w/proposed time
2) Observations of massive stars for high mass ratio binaries. Quick synopsis: only able to get test data last run that was almost totally lost to weather

Thanks a lot. My students enjoyed seeing several of your students at the recent meeting in Biosphere, and perhaps we can all drive down to Tucson and meet at some other time now that the paper proposal pilgrimage has ended and there are electronic submissions.

-- Jenny

Name	RA	DEC	Vmag	Kmag	Note
HIP4569	00 58 27.93429	-27 51 25.3049	11.80	6.89	Stellar target
HIP4872	01 02 38.86846	+62 20 42.1726	9.56	5.371	Substellar candidate
HIP12097	02 35 53.30841	+20 13 11.5791	10.63	6.33	Stellar target
HIP15220	03 16 13.81418	+58 10 02.5796	10.53	6.57	Stellar target
HIP15638	03 21 21.77972	+79 58 02.1261	11.21	6.89	Stellar target
HIP19337	04 08 37.39636	+33 38 13.3240	10.16	6.18	Stellar target
HIP21088	04 31 11.52059	+58 58 37.4806	11.08	5.72	Substellar candidate
HIP22762	04 53 49.97976	-17 46 24.2944	10.89	6.60	Stellar target
HIP24284	05 12 42.22640	+19 39 56.3708	10.75	6.47	Stellar target
HIP25953	05 32 14.65724	+09 49 14.9098	11.53	6.56	Stellar target
HIP26801	05 41 30.72782	+53 29 23.2779	9.87	5.76	Stellar target
HIP28035	05 55 43.21315	-26 51 23.4156	10.82	6.29	Stellar target
HIP28368	05 59 37.75412	+58 35 34.8499	10.26	6.21	Stellar target
HIP29295	06 10 34.61533	-21 51 52.7117	8.125	4.166	Substellar candidate
HIP34115	07 04 25.94034	+68 17 19.6822	11.76	7.27	Stellar target
HIP35353	07 18 08.18179	+39 16 29.3336	10.39	6.37	Stellar target
HIP52600	10 45 21.48828	+38 30 42.3470	9.27	5.55	Stellar target
HIP56157	11 30 41.82360	-08 05 42.9317	12.01	7.15	Stellar target
HIP60444	12 23 33.18441	+67 11 17.9164	11.54	6.81	Stellar target
HIP61706	12 38 52.44015	+11 41 46.1767	11.50	6.69	Stellar target
HIP65714	13 28 21.07950	-02 21 37.0186	11.34	6.61	Stellar target
HIP66077	13 32 44.60871	+16 48 39.0197	11.40	6.83	Stellar target
HIP70475	14 24 55.98373	+08 53 15.4283	12.26	7.59	Stellar target
HIP70865	14 29 29.69845	+15 31 57.5015	10.68	6.39	Stellar target
HIP72509	14 49 31.76303	-26 06 42.6229	12.07	7.91	Stellar target
HIP72511	14 49 32.62621	-26 06 20.1915	11.66	7.62	Stellar target
HIP74190	15 09 35.59099	+03 10 00.5776	11.47	6.86	Stellar target
HIP78353	15 59 53.38296	-08 15 11.5236	10.49	6.34	Stellar target
HIP79431	16 12 41.77667	-18 52 31.7905	11.37	6.59	Stellar target
HIP83609	17 05 20.95264	-33 46 03.4415	7.60	6.97	Stellar target
HIP84521	17 16 40.98082	+08 03 30.2292	11.53	7.11	Stellar target
HIP84794	17 19 54.20401	+26 30 03.1084	11.29	6.42	Stellar target
HIP91430	18 38 44.74773	-14 29 26.0319	11.22	6.85	Stellar target
HIP93101	18 58 00.13650	+05 54 29.2264	9.217	5.357	Substellar candidate
HIP93873	19 07 05.56328	+20 53 16.9672	10.774	6.521	Substellar candidate
HIP93899	19 07 13.20313	+20 52 37.2403	10.771	6.517	Substellar candidate
HIP97241	19 45 49.73950	+32 23 13.6249	11.07	6.774	Substellar candidate
HIP100923	20 27 41.66086	-27 44 51.7148	11.43	6.86	Stellar target
HIP103800	21 01 58.64291	-06 19 07.4949	11.22	6.69	Stellar target
HIP104432	21 09 17.42651	-13 18 09.0125	10.87	6.91	Stellar target
HIP106811	21 38 00.38433	+27 43 25.4747	9.77	5.92	Stellar target
HIP108706	22 01 13.12547	+28 18 24.8670	11.49	6.777	Substellar candidate
HIP109638	22 12 35.94868	+08 33 11.6703	11.98	7.47	Stellar target
HIP111313	22 33 02.22580	+09 22 40.7034	10.37	6.36	Stellar target