EUROPEAN SOUTHERN OBSERVATORY

Organisation Européenne pour des Recherches Astronomiques dans l'Hémisphère Austral
Europäische Organisation für astronomische Forschung in der südlichen Hemisphäre

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APPLICATION FOR OBSERVING TIME PERIOD: **86A**

Important Notice:

By submitting this proposal, the PI takes full responsibility for the content of the proposal, in particular with regard to the names of CoIs and the agreement to act according to the ESO policy and regulations, should observing time be granted

1. Title Category: **C–7**

PARSEC - PARallaxes of Southern Extremely Cool objects

2. Abstract / Total Time Requested

Total Amount of Time:

To understand the intrinsic properties of ultra cool dwarfs and ultimately massive Jupiter-like exoplanets, it is essential to determine their absolute luminosities. The only direct method to achieve this is with trigonometric parallaxes. Here we propose to complete PARSEC, a systematic determination of 140 L and bright T dwarf parallaxes, objects that are not the focus of any other program but fundamental to our understanding of the star/planet transition. This sample will allow us to examine in fine detail the faint luminosity - spectral type relation and will reveal interesting exceptions with anomalous colors and/or luminosities. This is a continuation of a program started in 2007 and will finish in this period.

3. Run	Period	Instrument	Time	Month	Moon	Seeing	Sky	Mode	Type
A	86	WFI	3n=3x1	nov	n	1.2	THN	v	
B	86	WFI	3n=3x1	dec	n	1.2	THN	v	
C	86	WFI	3n=3x1	feb	n	1.2	THN	v	
D	86	WFI	3n=3x1	mar	n	1.2	THN	v	

4. Number of nights/hours	Telescope(s)	Amount of time
a) already awarded to this project:	WFI	22n:Brazilian, 16n:ESO
b) still required to complete this project:		

5. Special remarks:

This proposal is continuation of a program that began in 2007 and obtained the first ESO time in P82. The core proposal is substantially the original one. We have updated the immediate objectives and Time Justification.

6. Principal Investigator: RSMART

6a. Co-investigators:

A. H.	Andrei	1599
H. R. A.	Jones	1668
M. G.	Lattanzi	1346
B.	Goldman	1489

Following CoIs moved to the end of the document ...

7. Is this proposal linked to a PhD thesis preparation? State role of PhD student in this project

8. Description of the proposed programme

A) Scientific Rationale:

L and T dwarfs are ultracool objects cooler than M dwarfs. A large fraction of L dwarfs and all T dwarfs are expected to be sub-stellar and thus also known as brown dwarfs. They have spectra dominated by molecular absorption due to water, methane and pressure-induced molecular hydrogen. Since the L/T dwarf spectral class was defined over a decade ago there have been over 700 discovered primarily from the 2MASS, SDSS, DENIS and more recently the UKIDSS survey. This proposal is to determine parallaxes for 140 L and bright T dwarfs. Since these objects have such a short observational history compared to main sequence stars it is useful to examine directly what parallaxes can supply.

Parallaxes in exploration of the L-T dwarf H-R Diagram: Unlike main sequence stars where colors are an indication of temperature, for these objects colors are more indicative of physical processes in the atmosphere. Between late L and early T dwarfs there is a rapid transition in their near infrared colors: after getting monotonically redder along the L dwarf sequence, the infrared colors suddenly turn blue at the L/T transition. Many late L dwarfs actually appear to be fainter than early T dwarfs, producing a 'hump' in the color-magnitude diagram. This effect was not predicted by the models and was only seen once a few trigonometric parallaxes became available to provide absolute luminosities for these objects. As the pool of parallaxes increases we will be able to examine in finer detail this region of the H-R diagram.

Parallaxes in the modeling of L-T dwarfs: A number of models have been proposed to address the observational characteristics of L-T dwarfs: Allard and co-workers [1] are running 3D convection models to estimate the likelihood of cloud-clearing through L and T dwarfs; Helling et al. [8] are focused on a self-consistent treatment of seed formation, growth, evaporation, gravitational settling and element conservation; Marley & Saumon's group have focused on non-equilibrium models (e.g. Leggett et al. [11]) with very careful treatment of vertical mixing and sedimentation efficiency. Thus a number of theoretical groups are producing a variety of somewhat different explanations and treatments. Empirical data, where parallaxes are crucial, will be necessary to test the different theoretical scenarios. As an example we reproduce in figure 1 the model E from Burrows et al. [6] with the current observational record over-plotted: it is clear that the models are currently unconstrained, see the conclusions of this article for specific speculations about models.

Another example of the difficulties in modeling of L/T dwarfs can be seen in figure 2 (reproduced from Kirkpatrick et al [10]) where the spectra of three objects, classified in the optical and J-band as L7, are over-plotted. While the spectral profiles are similar in the optical/near IR, hence the identical spectral classification, the longer wavelength spectra show strong variations. The distance is an atmosphere-independent parameter that will help resolve these seeming inconsistencies.

Parallaxes in the identification of outliers: Our target list has over 140 objects, over two times the number of L and bright T dwarfs with known parallaxes. This dataset, in addition to providing constraints on the models and exploring the fine structure of the H-R diagram, will inevitably contain a number of objects with anomalous colors or luminosities. We underline that parallaxes are the only model independent way to absolute luminosities. If we find objects with an over luminosity with respect to that predicted by their color, then it is most likely a binary object and will be a primary candidates for follow-up observations which will lead to mass and evolution constraints. If we find the object is under-luminous then it is most likely a sub-dwarf and hence probably not of thin disk origin but from the halo or thick disk - which all become prime candidates for constraining the dwarf models using galaxy models or vice versa constraining the galaxy using dwarf models. Since these are low-mass close-by objects we can even search for the astrometric signature of planetary mass companions. Although the precision per observation and sampling limits the discovery space to a small probability of a new discovery, the size of the dataset will allow us to set statistically significant upper limits on the size of possible planetary companions.

Proper motions and serendipitous objects: In addition to the determination of parallaxes these observations, in conjuction with the 2MASS catalog, allow us to find proper motions for all objects. As shown in Jameson et al. [9] the proper motions can be used to associate these objects to known moving groups which in turn set age and composition limits. Also we will use the large field of the WFI to search for possible wide binaries; again, having such a large dataset and a large field will allow us to place significant constraints on the binarity frequency. Finally, we will also search the field for other interesting objects: unrelated high proper motion objects for which we can determine parallaxes, QSO candidates using both color and proper motion constraints, variable stars, etc. In figure 4, as an example of the data quality being obtained for this program, we show the classical reduced proper motion diagram based on the first estimate of proper motions. This diagram has been used to highlight candidate brown dwarfs for spectroscopic follow-up on the SOAR telescope. See also section 8B and figure 6 where we show a new common proper motion object discovered in this program.

Relation to other programs: Most of these objects will **not** be observed by Gaia, and, those that are, will be close to Gaia's magnitude limit, so probably the ground based parallax will be more precise [12]. These objects are not the focus of any other ground based program and to our knowledge there is no other program of this size aimed at the determination of L and bright T dwarfs.

The large majority of the observational time for this program has been provided under the Brazilian time allocation; however, this time has finished and to complete the program we need observations through 2010. We

8. Description of the proposed programme (continued)

have requested 12 nights this semester as we were only granted 6 of the 9 requested in P85. This program has a guaranteed scientific return in the form of fundamental distances, multiple epoch photometry, proper motions and probably a number of serendipitous discoveries. In figure 3 we plot all brown dwarfs with known parallaxes as a function of spectral type and over-plot the sample in this study. Given the diversity of colors and dust properties in a given spectral subclass we estimate the minimum number of objects required to have a robust precise photometric calibration is 10 per spectral bin. The PARSEC program will provide this number for most of the L types and contribute to T types. For the fainter T types we have other programs on 4m class telescopes to reach an overall minimum of 10 objects per subclass for the whole L-T spectral range.

B) Immediate Objective: With this sample we will double the number of L dwarfs and bright T dwarfs with precise parallaxes providing distances with precisions better than 10%. This program will allow a substantial improvement on the calibration of L/T dwarf luminosities, allowing a direct confrontation with the structure models for sub-stellar objects. There will also undoubtedly be outliers to the calibration that will give valuable indications of the physical processes that these objects are undergoing, following the maxim of the "exception proves the rule". Finally the coverage of the L-T boundary objects will provide a consistent set of data for the study of this poorly understood region.
As an indication of the quality of the WFI observations we reproduce in figure 5 the solution for the L0 dwarf k0719s50 after 24 months of observations. The parallactic motion is clear and a provisional solution provides a distance of 28.5 +/- 2.5 pc, in line with simulations. We also plot in figure 6 the proper motions of all the objects within 2" of k0719s50, the target star is #32 and #28 has a very similar proper motion. Follow-up work using photometric parallaxes has shown that star #28 is a M3-M4 dwarf companion to k0719s50. We can now use calibrated M dwarf models, and high resolution spectra of the brighter object to constrain the age and chemical composition of k0719s50. This object then becomes a benchmark for other objects of the same type.
The results for k0719s50, first parallaxes for other selected objects and a large proper motion catalog have been submitted for publication [13]. Related to this program we have submitted a paper on the parallaxes of red dwarfs in the Torino Observatory Parallax Program [14] and another on the parallax of the T9 dwarf ULAS J003402.77-005206.7 [15], one of the coolest brown dwarfs discovered to date.
PARSEC is an integral part of two successful European Union Marie Curie International Fellowships. One is an International Incoming Senior Fellowship for A. Andrei to work at the Osservatorio Astronomico di Torino (OATo) for 2 years on PARSEC. The other is "Interpretation and Parameterisation of Extremely Red Cool Objects" a 4 year staff exchange scheme between OATo, the University of Hertfordshire, Shanghai Astronomical Observatory and the Brazilian National Observatory. One goal of these proposals is to build a real time database, for use internally and eventually released publically, of all the observations coming from the various spectroscopic, photometric and parallax programs within the consortium. TOPP is looking at red dwarfs, PARSEC covers the L/early T dwarfs and our UKIRT/NTT programs cover the faintest T dwarfs. PARSEC also forms part of the Masters thesis of a student at the University of Hertfordshire and one at OATo. Finally, we have extended the collaboration to researchers at the University of Chile (Costa, Day-Jones, Mendez) and to MPIA (Goldman) who have extensive experience in exploiting parallax observations and searching for binary systems.

C) Telescope Justification: The ESO 2.2m telescope has an optimum size for this project as these objects are too faint for the 1m class telescopes where there are ongoing optical parallax programs. Due to the rapid increase in the number of known L dwarfs we had the luxury to be able to be very selective in our target list for this program and, as such, we have optimised the magnitude range for the 2.2m telescope. Also as discussed in section 9 (Time Justification) we already have a number of observations on this telescope using Brazilian and ESO time and a requirement of any ground-based parallax program is that the observations are carried out on the same telescope. Finally, this instrument/telescope combination has already been used for parallax determinations [7].

D) Observing Mode Justification (visitor or service): Only offered in visitor mode.

E) Strategy for Data Reduction and Analysis: The applicants are experts in astrometry using ground based observations [2,3,16]. We are principal investigators in other major parallax programs in the infrared on 4m class telescopes and in the optical on 1m class telescopes [4,5,14,15]. The overall procedures and strategy will therefore follow those programs with the only unknown being how well we could centroid on a given WFI frame. This was tested using early frames of the same field from different nights we calculated the distances between pairs of stars (each star being used only once) and compared these distances between the two nights. The mean error from this test was 0.02 pixels which translates into a per-observation precision of 5mas. From simulations [17] we estimate that with 20 epochs at this precision over 3-4 years, we can obtain parallaxes with errors less than 2mas. In figure 7 we show the distribution of observations per target in the first 2.5 years, if granted the time here we will have the required 20 observations for the majority of the targets. The first results recently submitted support these error estimates.

8. Attachments (Figures)

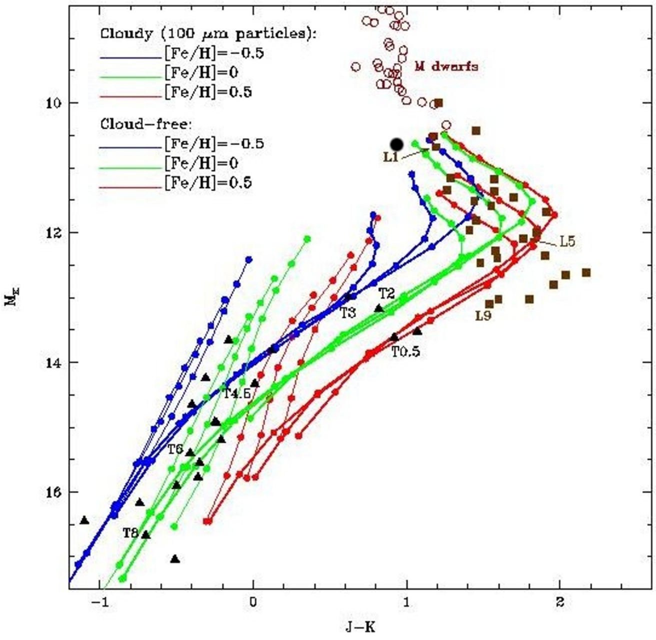


Figure 1

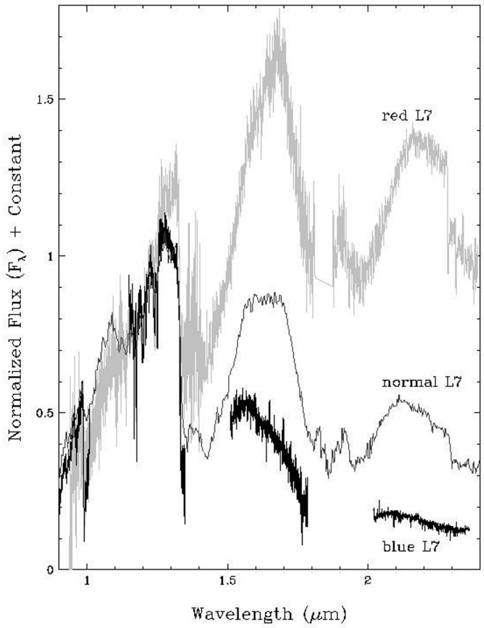


Figure 2

Figure 1: The model E from Burrows et al. (2007 Fig. 18) one of a family of plausible models explaining L dwarfs and the L to T dwarf transition. Overplotted are derived data for all the L and T dwarfs with known parallaxes.
Figure 2: Reproduced from Kirkpatrick et al. 2008 an over-plot of three objects typed as L7 in J-band. Shown are an unusually red L7 (top, light grey), a normal L7 (middle, dark grey), and a blue L7 (bottom, black). All spectra have been normalised at 1.2 μm.

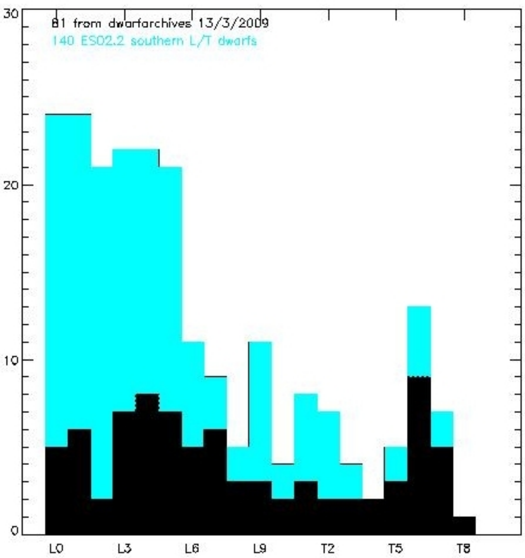


Figure 3

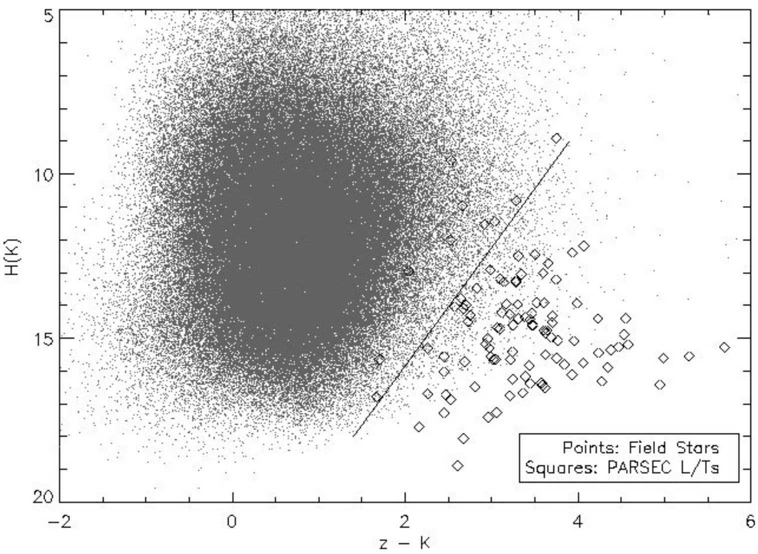
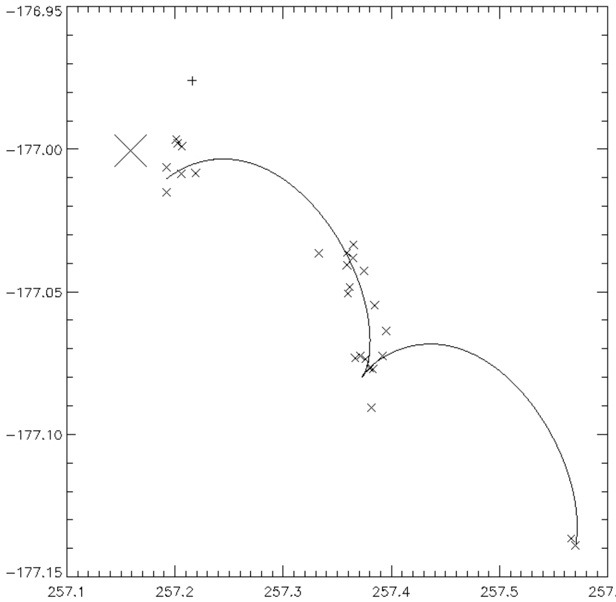


figure 4

Figure 3: The distribution of all cool dwarfs with measured parallaxes vs spectral type in black. The contribution expected from the PARSEC program in blue.
Figure 4: A reduced proper motion diagram for objects in the PARSEC fields. Proper motions were found from a match to the 2MASS catalog and first ESO2.2/WFI observations made under Brazilian time. The squares are the PARSEC L/T targets, the points in this region are possible new L/T dwarfs that are the subject of a spectroscopic follow-up proposal to the SOAR telescope.

8. Attachments (Figures)



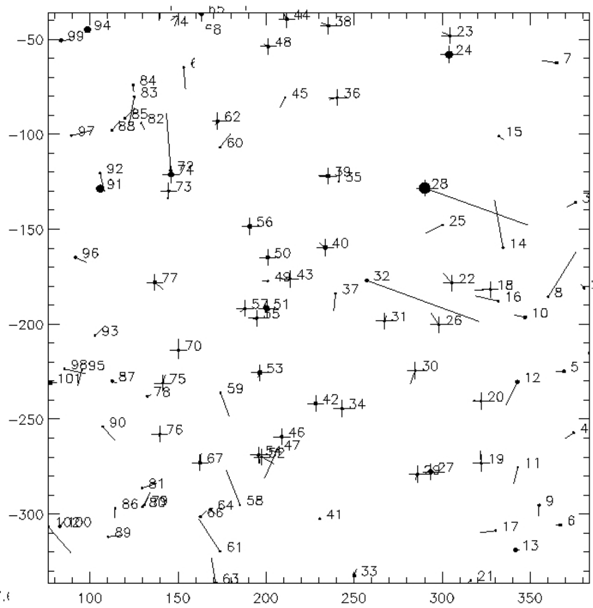


Figure 5: The first 24 months of observations of the L0 dwarf k0719s50 with an evident parallactic motion.
Figure 6: Proper motions of all objects within 1” of k0719s50 (object #32). The object #28 has the same proper motion and follow-up photometric parallaxes identify it as a M dwarf at the same distance as k0719s50. This is a binary system that we can exploit to place constraints on the L0 class in our benchmarks programme (e.g. Day-Jones et al. 2008).

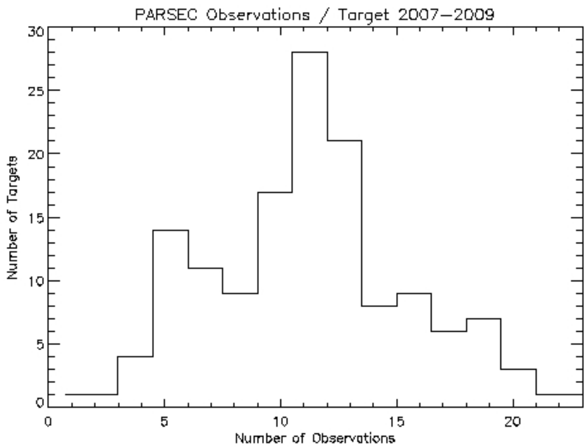


Figure 7: Distribution of the number of observations for each PARSEC target over the 2.5 years from 4/2007 to 10/2009.

References:

[1] Allard F., et al., 2007, IAUS 240, 332; [2] Andrei A. H., et al., 1999, AJ, 117, 483; [3] Assafin M., et al., 2007, A&A, 476, 989; [4] Smart R. L., et al., 2003, A&A, 404, 317; [5] Smart R. L., et al., 2007, A&A, 464, 787; [6] Burrows et al., 2007, ApJ, 640, 1063; [7] Ducourant, C. et al. 2007, A&A, 470, 387; [8] Helling C., et al., 2008, ApJ, 675, L105; [9] Jameson R. F., et al., 2008, MNRAS, 384, 1399 ; [10] Kirkpatrick et al. 2008, http://arxiv.org/abs/0704.1522v1; [11] Leggett et al., 2007, ApJ, 655, 1079; [12] Smart R. L., et al., 2008, IAUS 248; [13] Andrei, A. et al., 2010 submitted to AJ; [14] Smart, R. L. et al., 2010 A&A Accepted; [15] Smart, R. L. et al., 2010 A&A, 511, 30; [16] Smart R. L., et al., 1999, A&A, 348, 653; [17] Smart R. L, et al., 2001, ASPC, 232, 335;

9. Justification of requested observing time and lunar phase

Lunar Phase Justification: There is no requirement on lunar phase.

Time Justification: (including seeing overhead) The time request in the application is a significant fraction of the total ESO European allocation. This is required as during P84 we were not granted any time and in P85 we were granted only 6 of the 9 requested nights and if we do not quickly complete the observational program there is a possibility that it will be completely compromised. This is because the determination of parallaxes requires a stable system and experience has shown that all optical systems evolve, the CCDs shift in the focal plane, the filters change shape, the pixel columns shift, routine maintenance changes the astrometric distortion pattern. The length of a program is therefore a balance between as-short-as-possible for stability and as-long-as-possible to improve the proper motion determination. If we finish the program in this period, P86, we have found a good compromise. Drag the program out, the system will eventually evolve and the astrometric precision will degrade. In the publication on this program already submitted (Andrei et al submitted to AJ) we have included provisional solutions for 10 objects so we know that we can be successful in our final goal.
In P85 we requested 9 nine nights of which 6 were granted. Here we request 12 nights to make up for the short fall. As we said in the original proposal to be successful we require 20 observations per target which equates to to a minimum of 40 nights for objects at all right ascensions. Allowing for nights lost to bad weather and the $\sim$15% used by GROND, our total requested allocation of 50 (i.e. 38 granted and 12 requested here) is consistent with this minimum. If granted this time we will finish the observations this semester. As shown in Figure 7 these estimates are inline with the current observational history.
We request a run split of 1,3w,1,3w,1 this increases the probability of observation and ensures that separate observations sample different parts of the parallax ellipse. Consecutive nights are acceptable though less useful.

Calibration Request: Standard Calibration

10. Report on the use of ESO facilities during the last 2 years

082.C-0946, 083.C-0446 & 085.C-0690 16n 2.2m time. Parallaxes of Southern Extremely Cool objects. Preliminary results publication submitted, time requested to finish the program.
082.C-399 & 081.C-0552 6+6N NTT time. z band imaging of T dwarf and high redshift quasar candidates. T8.5+M4 binary discovered (Burningham 2009 MNRAS 395), various isolated T dwarf discoveries (Pinfield 2008 MNRAS 390 & Lodieu 2007 MNRAS 379), including four T8.5+ dwarfs (Burningham 2008 MNRAS 391) with the first T9 ULAS J0034-00 (Warren 2007 MNRAS 381) and the coolest yet ULAS1335+1130 the first UKIDSS high-z quasar (z=5.86,(Venemans 2007 MNRAS 376L)) and a $z = 6.14$ quasar (Mortlock 2008 arXiv)

11. Applicant's publications related to the subject of this application during the last 2 years

Andrei, A. et al., submitted to AJ: PARSEC I: Targets, Proper motions and first results.
Smart, R. L. et al., 2010 A&A Accepted: Cool dwarfs stars from the Torino Observatory Parallax Program
Smart, R. L. et al., 2010 A&A, 511, 30: A distance to the T9 cool dwarf ULAS J003402.77-005206.7
Clarke, J. R. A., et al., 2010 MNRAS 402, 575: A search for southern ultracool dwarfs in young moving groups.
Leggett, S. K., et al., 2010 ApJ 710, 1627: Mid-Infrared Photometry of Cold Brown Dwarfs
Goldman, B., et al., 2010 arXiv:1002.2637: A new benchmark T8-9 brown dwarf and a couple of new...
Quanz, S. P., et al., 2010 ApJ 708, 770: Search for Very Low-Mass Brown Dwarfs and Free-Floating Planetary...
Nedelcu et al., 2010 A&A509, 27: Apparent close approaches between near-Earth asteroids and quasars.
Day-Jones, A. C., et al., 2009 arXiv:0912.5339: The current population of benchmark brown dwarfs.
Zhang, Z. H., et al., 2009 arXiv:0911.4255: Benchmark ultra-cool dwarfs in widely separated binary systems.
Smart, R. L., 2009 MmSAI 80, 674: Brown dwarf parallax programs..
Goldman, B., et al., 2009 A&A 502, 929: Polarisation of very-low-mass stars and brown dwarfs.
Andrei, A. H., et al., 2009 A&A, 505, 385 The Large Quasar Reference Frame
Burningham, B., et al., 2009 MNRAS 395 1237: The discovery of an M4+T8.5 binary system.
Leggett, S. K., et al., 2009 ApJ 695 1517: The Physical Properties of Four 600 K T Dwarfs.
Souchay, J., et al., 2009 A&A 494 799: The construction of the large quasar astrometric catalogue.
Subasavage, J. P., et al., 2009 AJ 137 4547: The Solar Neighborhood. XXI. Parallax from the CTIOPI 0.9
Zhang, Z. H., et al., 2009 A&A 497 619: New Ultra-cool dwarfs form the SDSS.
Burningham, B., et al. 2008 MNRAS 391 320: Exploring the substellar regime down to 550K
Day-Jones, A., et al. 2008 MNRAS 388 838: Discovery of a wide ultracool dwarf-white dwarf binary
Pinfield D.J., et al. 2008 MNRAS 390 304: Fifteen new T dwarfs discovered in the UKIDSS LAS
Smart, R. L., et al., 2008 IAUS 248 429: L and T dwarfs in Gaia/SIM.
Goldman, B., et al., 2008 A&A 490, 763: Binarity at the L/T brown dwarf transition.
Souchay et al., 2008 A&A485, 299: Astrometric comparisons of quasar catalogues

12. List of targets proposed in this programme

Run	Target/Field	α(J2000)	δ(J2000)	ToT	Mag.	Diam.	Additional info	Reference star
ABCD	k0004s40	0 4 34.84	-40 44 5.80	480	15.8	6 mas	L5 2	
ABCD	k0006s17	0 6 20.50	-17 20 50.60	480	18.4	6 mas	L2 3	
ABCD	k0010s20	0 10 0.09	-20 31 12.20	480	16.5	6 mas	L0 3	
ABCD	k0013s22	0 13 57.79	-22 35 20.00	480	18.6	6 mas	L4 2	
ABCD	k0014s48	0 14 55.75	-48 44 17.10	480	16.8	6 mas	L2 3	
ABCD	k0016s40	0 16 59.53	-40 56 54.10	480	18.0	6 mas	L3 3	
ABCD	s0030s37	0 30 6.26	-37 39 48.20	480	17.9	6 mas	L3 1	
ABCD	k0032s44	0 32 55.84	-44 5 5.80	480	17.1	6 mas	L0 2	
ABCD	k0032s22	0 32 43.08	-22 37 27.20	480	17.9	6 mas	L1 2	
ABCD	k0033s15	0 33 23.86	-15 21 30.90	480	18.0	6 mas	L2 3	
ABCD	k0034s07	0 34 56.84	-7 6 1.30	480	18.2	6 mas	L3 3	
ABCD	k0051s15	0 51 10.78	-15 44 16.90	480	18.0	6 mas	L3 3	
ABCD	k0053s36	0 53 18.99	-36 31 10.20	480	17.2	6 mas	L3 3	
ABCD	k0054s00	0 54 6.55	-0 31 1.80	480	18.3	6 mas	L1 2	
ABCD	s0058s06	0 58 42.47	-6 51 23.10	480	17.1	6 mas	L4 1	
ABCD	s0109s51	1 9 1.16	-51 0 50.70	480	14.6	6 mas	L0 1	
ABCD	k0117s34	1 17 47.48	-34 3 25.80	480	17.9	6 mas	L2 2	
ABCD	s0123s36	1 23 0.50	-36 10 30.60	480	16.4	6 mas	L2 1	
ABCD	k0125s34	1 25 36.89	-34 35 4.90	480	18.3	6 mas	L2 2	
ABCD	s0128s55	1 28 26.76	-55 45 34.50	480	16.6	6 mas	L4 1	
ABCD	k0144s07	1 44 35.36	-7 16 14.20	480	16.9	6 mas	L5 2	
ABCD	s0147s49	1 47 32.82	-49 54 47.90	480	15.8	6 mas	L2 1	
ABCD	k0205s11	2 5 29.40	-11 59 29.60	480	17.4	6 mas	L6 1	
ABCD	k0218s31	2 18 29.13	-31 33 23.00	480	17.4	6 mas	L3 3	
ABCD	k0219s19	2 19 28.07	-19 38 41.60	480	16.9	6 mas	L2 3	
ABCD	k0227s16	2 27 10.36	-16 24 47.90	480	16.1	6 mas	L1 2	
ABCD	s0230s09	2 30 44.99	-9 53 5.10	480	17.7	6 mas	T0 1	
ABCD	k0235s23	2 35 59.93	-23 31 20.50	480	15.2	6 mas	L1 2	
ABCD	k0235s08	2 35 47.56	-8 49 19.80	480	18.3	6 mas	L2 2	
ABCD	s0239s17	2 39 42.40	-17 35 46.10	480	16.6	6 mas	L0 1	
ABCD	k0243s24	2 43 13.71	-24 53 29.80	480	18.9	6 mas	T6 2	
ABCD	k0255s47	2 55 3.57	-47 0 50.90	480	16.1	6 mas	L9 1	
ABCD	k0257s31	2 57 25.81	-31 5 52.30	480	17.6	6 mas	L8 1	
ABCD	k0310s27	3 10 14.01	-27 56 45.20	480	18.5	6 mas	L5 2	
ABCD	k0318s34	3 18 54.03	-34 21 29.20	480	18.5	6 mas	L7 1	

Following targets moved at the end of the document ...

Target Notes: We have listed all our targets. Depending on when the nights are granted any of these may be observed during the 6 month period; indeed we expect to observe all of the objects more than once during the 6 month period. Once the nights have been allocated we will tailor the list accordingly. From previous runs we have seen that it is possible to make and average of 2 observations of all visible objects per 3-night run.

12b. ESO Archive - Are the data requested by this proposal in the ESO Archive (http://archive.eso.org)? If yes, explain why the need for new data.

No

13. Scheduling requirements

This proposal involves time-critical observations, or observations to be performed at specific time intervals.

1. Run Splitting

Run	**splitting**
A	1,3w,1,3w,1
B	1,3w,1,3w,1
C	1,3w,1,3w,1
D	1,3w,1,3w,1

14. Instrument configuration

Period	Instrument	Run ID	Parameter	Value or list
86	WFI	A	IMG	ESO846
86	WFI	B	IMG	ESO846
86	WFI	C	IMG	ESO846
86	WFI	D	IMG	ESO846

6b. Co-investigators:

...continued from page 1

B.	Bucciarelli	1346
J. I.	Camargo	1599
E	Costa	1823
M. T.	Crosta	1346
A. C.	Day-Jones	1823
M.	Darpa	1346
R	Mendez	1823
J. L.	Penna	1599
D.	Pinfield	1668
R.	Teixeira	1327
A.	Vecchiato	1346
V. A.	d'Ávila	1599

12a. List of targets proposed in this programme

Run	Target/Field	α(J2000)	δ(J2000)	ToT	Mag.	Diam.	Additional info	Reference star
	...continued from box 12							
ABCD	k0348s60	3 48 7.72	-60 22 27.00	480	18.8	6 mas	T7 2	
ABCD	k0350s05	3 50 48.61	-5 18 12.60	480	18.8	6 mas	L1 2	
ABCD	k0357s44	3 57 26.95	-44 17 30.50	480	16.7	6 mas	L0 2	
ABCD	k0357s06	3 57 21.10	-6 41 26.00	480	18.3	6 mas	L0 2	
ABCD	k0408s14	4 8 29.05	-14 50 33.40	480	16.9	6 mas	L3 2	
ABCD	k0423s04	4 23 48.58	-4 14 3.50	480	17.3	6 mas	L9 1	
ABCD	k0439s23	4 39 1.01	-23 53 8.30	480	17.3	6 mas	L6 1	
ABCD	k0443s32	4 43 5.81	-32 2 9.00	480	18.0	6 mas	L5 2	
ABCD	k0518s28	5 18 59.95	-28 28 37.20	480	18.8	6 mas	L9 1	
ABCD	k0523s14	5 23 38.22	-14 3 2.20	480	15.9	6 mas	L4 2	
ABCD	s0539s00	5 39 51.85	-0 59 5.20	480	16.7	6 mas	L3 1	
ABCD	k0559s14	5 59 19.14	-14 4 48.80	480	17.3	6 mas	T5 2	
ABCD	s0614s20	6 14 11.84	-20 19 14.60	480	17.6	6 mas	L4 1	
ABCD	k0624s45	6 24 45.95	-45 21 54.80	480	17.2	6 mas	L5 2	
ABCD	k0639s74	6 39 55.96	-74 18 44.70	480	18.5	6 mas	L5 2	
ABCD	k0641s43	6 41 18.40	-43 22 32.90	480	16.3	6 mas	L1 2	
ABCD	k0719s50	7 19 31.88	-50 51 41.00	480	16.5	6 mas	L0 2	
ABCD	r0729s78	7 29 11.54	-78 43 37.58	480	18.3	6 mas	L9 1	
ABCD	k0828s13	8 28 34.19	-13 9 19.80	480	15.6	6 mas	L2 2	
ABCD	k0832s01	8 32 4.51	-1 28 36.00	480	16.6	6 mas	L1 2	
ABCD	k0835s08	8 35 42.56	-8 19 23.70	480	15.9	6 mas	L5 2	
ABCD	k0859s19	8 59 25.47	-19 49 26.80	480	18.4	6 mas	L6 1	
ABCD	k0909s06	9 9 57.49	-6 58 18.60	480	16.2	6 mas	L0 2	
ABCD	k0921s21	9 21 14.10	-21 4 44.60	480	15.5	6 mas	L2 2	
ABCD	k0922s80	9 22 19.52	-80 10 39.90	480	18.1	6 mas	L4 2	
ABCD	k0928s16	9 28 39.72	-16 3 12.80	480	18.1	6 mas	L2 2	
ABCD	k0953s10	9 53 21.27	-10 14 20.57	480	15.8	6 mas	L0 2	
ABCD	k1004s33	10 4 39.29	-33 35 18.90	480	17.3	6 mas	L4 2	
ABCD	s1004s13	10 4 40.31	-13 18 18.70	480	17.6	6 mas	T0 1	
ABCD	k1018s29	10 18 58.79	-29 9 53.50	480	16.7	6 mas	L1 2	
ABCD	k1045s01	10 45 24.00	-1 49 57.60	480	15.7	6 mas	L1 2	
ABCD	k1047s18	10 47 31.09	-18 15 57.40	480	17.0	6 mas	L2 2	
ABCD	k1058s15	10 58 47.87	-15 48 17.20	480	16.9	6 mas	L3 2	
ABCD	k1059s21	10 59 51.38	-21 13 8.20	480	17.1	6 mas	L1 2	
ABCD	k1122s35	11 22 8.26	-35 12 36.30	480	18.1	6 mas	T2 2	
ABCD	k1122s39	11 22 36.24	-39 16 5.40	480	18.4	6 mas	L3 2	
ABCD	k1154s34	11 54 42.23	-34 0 39.00	480	16.6	6 mas	L0 2	
ABCD	k1225s27	12 25 54.32	-27 39 46.60	480	18.8	6 mas	T6 2	
ABCD	k1228s15	12 28 15.23	-15 47 34.20	480	17.2	6 mas	L6 1	
ABCD	s1246s31	12 46 29.65	-31 39 28.10	480	18.2	6 mas	T1 1	
ABCD	k1254s01	12 54 53.93	-1 22 47.40	480	18.0	6 mas	T2 2	
ABCD	k1326s27	13 26 20.09	-27 29 37.00	480	18.6	6 mas	L5 2	
ABCD	k1331s01	13 31 48.94	-1 16 50.00	480	18.4	6 mas	L7 2	
ABCD	k1341s30	13 41 11.60	-30 52 50.50	480	17.3	6 mas	L3 2	
ABCD	s1404s31	14 4 49.48	-31 59 33.10	480	18.8	6 mas	T1 1	
ABCD	k1425s36	14 25 27.98	-36 50 22.90	480	16.5	6 mas	L5 2	
ABCD	k1438s13	14 38 54.98	-13 9 10.30	480	18.2	6 mas	L3 2	
ABCD	k1441s09	14 41 37.16	-9 45 59.00	480	16.4	6 mas	L0 2	
ABCD	k1457s21	14 57 14.96	-21 21 47.70	480	18.8	6 mas	T7 2	
ABCD	k1507s16	15 7 47.69	-16 27 38.60	480	15.6	6 mas	L5 2	

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12a. List of targets proposed in this programme

Run	Target/Field	α(J2000)	δ(J2000)	ToT	Mag.	Diam.	Additional info	Reference star
	...continued from previous page.							
ABCD	k1520s44	15 20 2.24	-44 22 41.99	480	16.0	6 mas	L4 2	
ABCD	k1523s23	15 23 6.57	-23 47 52.64	480	17.0	6 mas	L2 2	
ABCD	r1530s81	15 30 32.98	-81 45 33.10	480	17.0	6 mas	L9 1	
ABCD	k1534s29	15 34 49.84	-29 52 27.40	480	18.4	6 mas	T6 2	
ABCD	k1539s05	15 39 41.89	-5 20 42.80	480	16.6	6 mas	L3 2	
ABCD	k1547s24	15 47 47.19	-24 23 49.30	480	16.3	6 mas	L0 2	
ABCD	k1548s16	15 48 58.34	-16 36 1.86	480	16.7	6 mas	L2 2	
ABCD	k1618s13	16 18 45.03	-13 21 29.70	480	16.6	6 mas	L0 2	
ABCD	k1620s04	16 20 26.14	-4 16 31.50	480	18.0	6 mas	L2 2	
ABCD	k1633s06	16 33 59.33	-6 40 55.20	480	19.0	6 mas	L6 1	
ABCD	k1636s00	16 36 0.78	-0 34 52.50	480	17.0	6 mas	L0 2	
ABCD	k1645s13	16 45 22.11	-13 19 51.60	480	15.0	6 mas	L1 2	
ABCD	k1705s05	17 5 48.34	-5 16 46.20	480	16.1	6 mas	L4 2	
ABCD	k1707s05	17 7 23.43	-5 58 24.90	480	16.7	6 mas	L3 2	
ABCD	s1737s10	17 37 43.36	-10 57 42.60	480	19.0	6 mas	T2 1	
ABCD	k1750s00	17 50 24.84	-0 16 15.11	480	16.0	6 mas	L5 2	
ABCD	k1753s65	17 53 45.18	-65 59 55.90	480	16.9	6 mas	L4 2	
ABCD	r1824s71	18 24 45.54	-71 28 16.47	480	18.5	6 mas	L9 1	
ABCD	k1828s48	18 28 35.72	-48 49 4.60	480	18.7	6 mas	T5 2	
ABCD	r1840s56	18 40 19.19	-56 31 11.47	480	18.9	6 mas	L9 1	
ABCD	k1928s43	19 28 51.96	-43 56 25.60	480	17.9	6 mas	L5 2	
ABCD	k1936s55	19 36 1.87	-55 2 32.20	480	17.2	6 mas	L5 2	
ABCD	k1956s17	19 56 15.42	-17 54 25.23	480	16.1	6 mas	L0 2	
ABCD	k2002s05	20 2 50.73	-5 21 52.40	480	18.2	6 mas	L6 1	
ABCD	s2011s62	20 11 56.49	-62 1 12.70	480	18.8	6 mas	T1 1	
ABCD	s2023s59	20 23 28.58	-59 46 52.00	480	18.7	6 mas	T1 1	
ABCD	k2026s29	20 26 15.84	-29 43 12.40	480	17.3	6 mas	L1 2	
ABCD	k2041s35	20 41 42.83	-35 6 44.20	480	17.6	6 mas	L2 2	
ABCD	s2045s63	20 45 2.27	-63 32 5.30	480	15.4	6 mas	L4 1	
ABCD	k2057s02	20 57 54.09	-2 52 30.20	480	15.6	6 mas	L1 2	
ABCD	s2101s29	21 1 52.33	-29 44 5.00	480	18.8	6 mas	T1 1	
ABCD	s2102s60	21 2 22.13	-60 46 18.20	480	18.8	6 mas	T2 1	
ABCD	k2104s10	21 4 14.91	-10 37 36.90	480	16.6	6 mas	L3 3	
ABCD	k2107s45	21 7 54.09	-45 44 6.40	480	17.3	6 mas	L0 2	
ABCD	k2130s08	21 30 44.64	-8 45 20.50	480	16.7	6 mas	L1 2	
ABCD	s2132s14	21 32 48.98	-14 52 54.50	480	19.0	6 mas	T3 1	
ABCD	s2148s63	21 48 13.26	-63 23 26.60	480	18.3	6 mas	L8 1	
ABCD	k2150s75	21 50 15.92	-75 20 36.70	480	16.6	6 mas	L1 2	
ABCD	k2157s55	21 57 49.04	-55 34 42.00	480	17.0	6 mas	L2 2	
ABCD	k2158s15	21 58 4.57	-15 50 9.80	480	17.8	6 mas	L4 2	
ABCD	k2204s56	22 4 10.52	-56 46 57.70	480	16.7	6 mas	T6 2	
ABCD	k2206s42	22 6 44.98	-42 17 20.80	480	18.3	6 mas	L2 2	
ABCD	s2209s27	22 9 21.84	-27 11 33.00	480	18.9	6 mas	T2 1	
ABCD	k2213s21	22 13 44.91	-21 36 7.90	480	17.9	6 mas	L1 2	
ABCD	k2224s01	22 24 43.81	-1 58 52.10	480	16.9	6 mas	L4 2	
ABCD	k2252s17	22 52 10.73	-17 30 13.40	480	17.2	6 mas	L7 1	
ABCD	k2254s28	22 54 51.94	-28 40 25.30	480	16.5	6 mas	L0 2	
ABCD	k2255s00	22 55 29.07	-0 34 33.60	480	18.0	6 mas	L0 2	
ABCD	k2310s17	23 10 18.46	-17 59 9.00	480	16.9	6 mas	L1 2	
ABCD	s2318s13	23 18 54.98	-13 1 10.70	480	18.8	6 mas	T3 1	

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12a. List of targets proposed in this programme

Run	Target/Field	α(J2000)	δ(J2000)	ToT	Mag.	Diam.	Additional info	Reference star
	...continued from previous page.							
ABCD	k2330s03	23 30 22.58	-3 47 18.90	480	17.0	6 mas	L1 2	
ABCD	k2344s07	23 44 6.24	-7 33 28.20	480	17.6	6 mas	L4 2	
ABCD	s2346s59	23 46 26.38	-59 28 42.70	480	17.3	6 mas	L5 1	
ABCD	k2351s25	23 51 50.44	-25 37 36.70	480	14.8	6 mas	L0 2	