



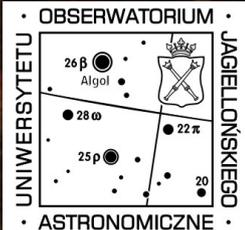
Southern African Large Telescope (SALT)



UNIwersYTET
MIKOŁAJA KOPERNIKA
W TORUNIU
Wydział Fizyki, Astronomii
i Informatyki Stosowanej



Uniwersytet
Wrocławski





SALT – 20 years



2000: Groundbreaking ceremony at Sutherland.

20th anniversary of the telescope's work, Sutherland, 10.11.2025 r.

Photo above, left to right:
Arkadiusz Swat, Anna Swat,
Marek Sarna, Jacek Chodorowicz,
Krzysztof Hełminiak



SALT – finances

- 2021 – 2025 Ministry of Science grant 2021/WK/01 (PI: M. Sarna)
 - In 2025: Extension till 03.2026
 - In 2025: Increase from 7 607 348,50 PLN → **7 785 824,50 PLN**
- **04.2026 – 03.2031 grant 2026/WK/02 (PI: K. Hełminiak)**
 - Total cost: **7 333 063,70 PLN**
 - 10 semesters, ~10% of telescope time
 - Access to 1.9-m Radcliffe, 1.0-m Elizabeth, 1.0-m Lesedi (3x/year)
 - SALT Scientific conference, Toruń, 05.2027



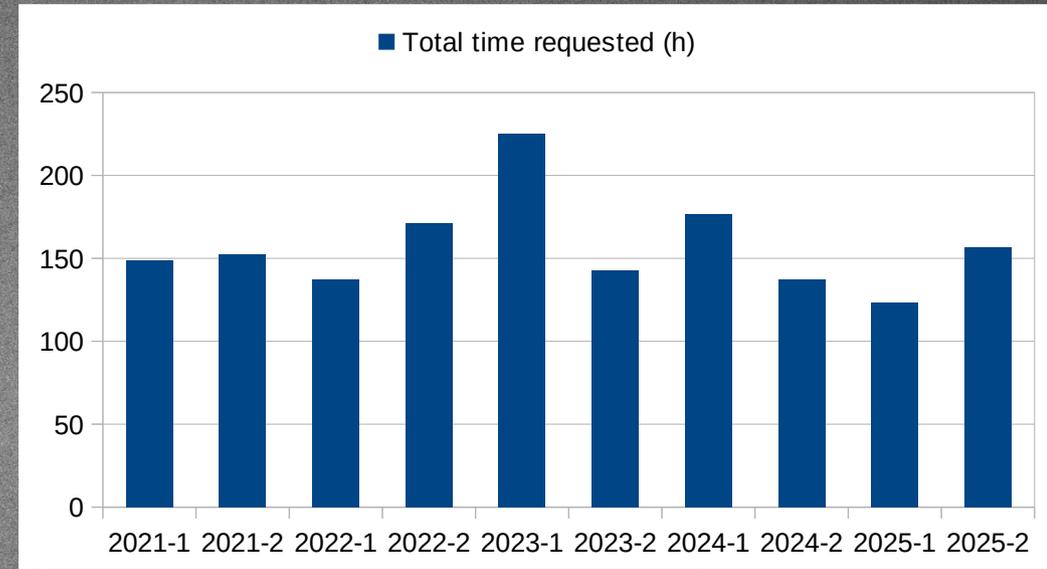
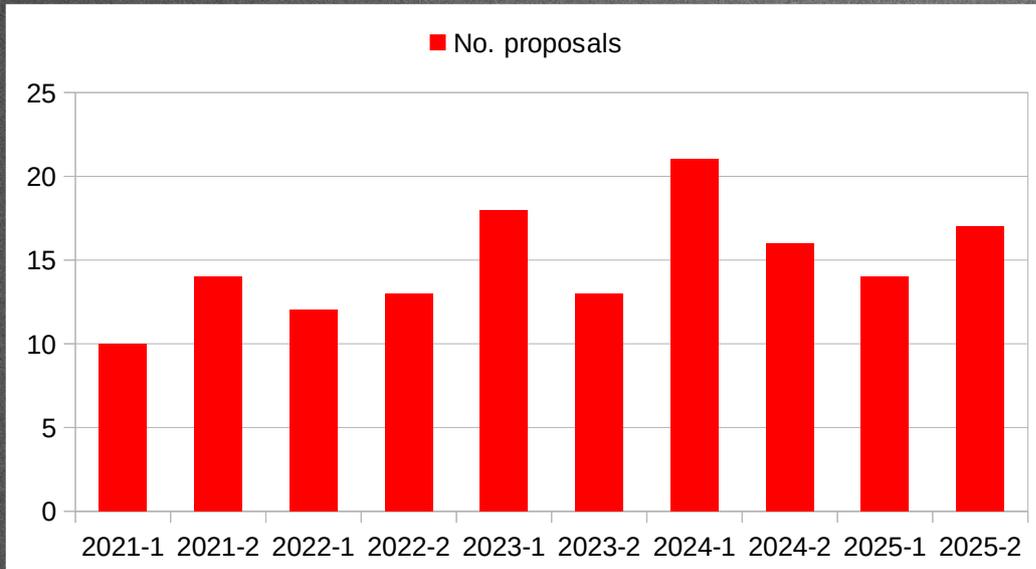
SALT – instruments

- RSS – low resolution spectrograph (and imager)
 - Long-slit spectroscopy
 - Narrow-band imaging
 - Multi-object spectroscopy (MOS)
 - High time-resolution spectroscopy and imaging
 - Long-slit spectropolarimetry
 - Slitmask Integral Field Unit (IFU) Spectroscopy 0.9" (200 μm) and 1.3" (300 μm) fibers
- HRS – high resolution spectrograph
 - High efficiency modes (R~14 000-65 000)
 - High stability mode (R~65 000)
 - Laser frequency comb (LFC) – soon
- NIRWALS – IR IFU spectrograph - soon





SALT – statistics '21-'25



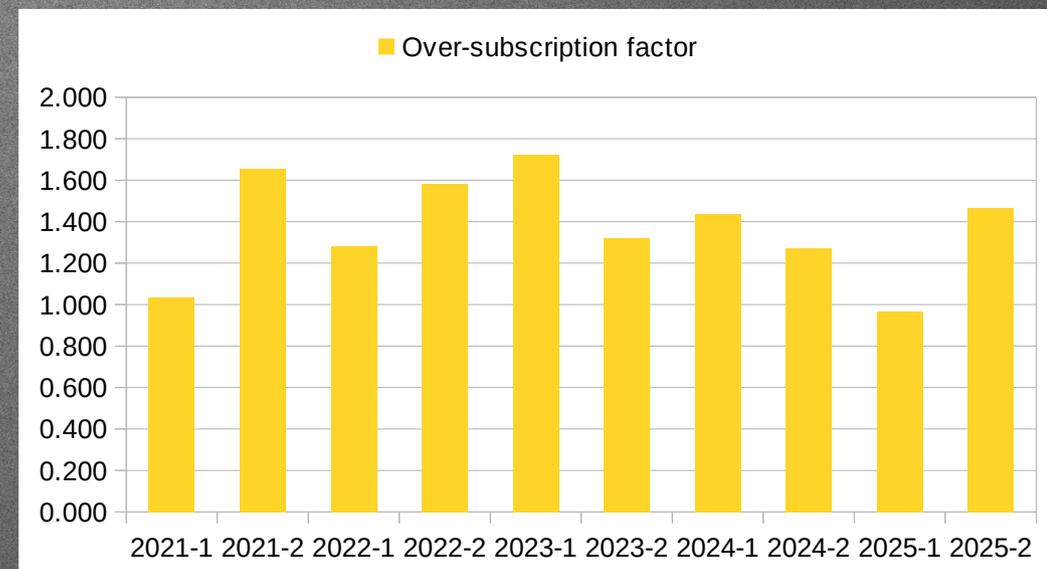
Total no. of proposals: **148**

Total time requested: **1571.17 h**

Total time allocated: **1154.60 h** (ESO: 1339 h)

Average OSF: **1.361**

Other SAAO telescopes: **171 n** allocated



Annual Report 2025

Krzysztof Hełminiak

A. Moharana, T. B. Pawar, G. Pawar, F. Marcadon, M. Konacki, A. Kalsi

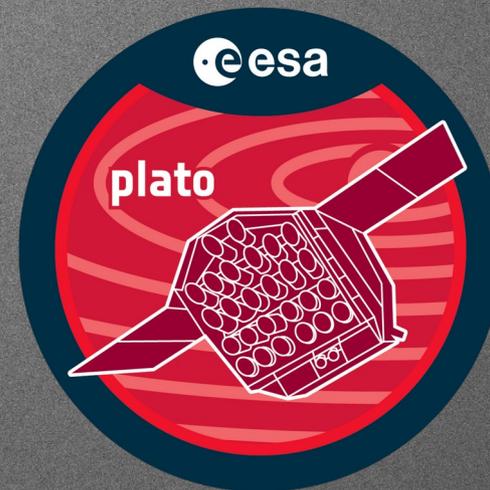
CAMK Toruń

Publications - DEBs

- Hełminiak K. G., et al. 2025, CoSka, 55, 438
"Adding TESS to CRÉME. Light curves and masses of 300+ eclipsing binaries"
- Moharana A., et al. 2025, CoSka, 55, 280
"Formation of compact hierarchical triples"
- Pawar T. B., et al. 2026, A&A, 705, A251
"A comprehensive study of δ Scuti-type pulsators in eclipsing binaries: oscillating eclipsing Algols "

Publications - Other

- Tsantaki M., et al. 2025, A&A, 697, A102
"Ariel stellar characterisation: III. Fast rotators and new FGK stars in the Ariel mission candidate sample"
(Ariel Mission consortium)
- Rauer H., et al. 2025, ExA, 59, 26
"The PLATO Mission"
(PLATO Mission consortium)



Presentations

- Conferences:

- **Detached eclipsing binaries and benchmark stars**, [Hełminiak, K.](#), Binary Stars in the Space Era, Keele University, UK
- Two circumbinary planet candidates detected with RVs around detached eclipsing binaries with solar analogs, [Hełminiak, K.](#); Graczyk D., Exploring Tatooine and Beyond: Circumbinary Planets with ESA Missions, Madrid, Spain
- Accelerating Detached Eclipsing Binaries with Brown Dwarfs (ADEBBDs) project, [Hełminiak, K.](#), 42. Zjazd Polskiego Towarzystwa Astronomicznego
- Accelerating Detached Eclipsing Binaries with Brown Dwarfs (ADEBBDs) project, [Hełminiak, K.](#); Gauza B., European Astronomical Society annual meeting 2025, Cork, Ireland
- Getting hands on what we have: CREME targets in LOPS2, [Hełminiak, K.](#); Pawar, G.; Pawar, T. B.; Moharana, A., European Astronomical Society annual meeting 2025, Cork, Ireland
- Detached eclipsing binaries as benchmarks in LOPS2 field of PLATO, Pawar., G.; [Hełminiak, K.](#); Moharana, A.; Pawar, T. B.; Miller, N.; Marcadon, F., European Astronomical Society annual meeting 2025, Cork, Ireland

- Seminars:

- Univ. of Patras, *"Light curves and masses of 300+ eclipsing binaries from the CRÉME project"*

Students

- **T. B. Pawar (CAMK → Villanova)**



- G. Pawar (CAMK)
- J. Olszewska (AO AMU)
- A. Kalsi (started 12.2025)

- L. Arora (UC SD, summer)
- J. Barchwic (UW, summer + B.Sc.)
- J. Pusz (UW, summer)



Observations

- SALT/HRS Long-Term (4 x 21h), PI: Moharana
- SALT/HRS Normal (12.5 h), PI: Pawar G.
- SALT/HRS Long-Term (6 x 20h), PI: Hełminiak
- LBT/PEPSI (5h), PI: Magrini
- VLT/UVES (45.5 h), PI: Danielski
- *VLT/UVES (80h), PI: Tsantaki – submitted for P117*
- *ESO-3.6/HARPS (3n), PI: Pawar G. - submitted for P117*
- TESS Guest Investigator Program in Cycle 8, PI: Hełminiak
- 50 hours of observing time on the SMARTS-1.5m/CHIRON - own purchase



Other

- Space missions:
 - ARIEL Mission Consortium (SC-Obs sWG coordinator)
 - PLATO Mission Consortium (Benchmark Stars, Binary and Multiple Stars)
- OPUS grant 2023/49/B/ST9/01671
- Reviews:
 - Publications: ApJ, Scientific Reports
 - Proposals: SALT PL TAC

CRÉME: new recent results

- Analysis of 19 low-mass ($< 0.9 M_{\text{SUN}}$) DEBs:
 - RV modelling: **finished**
 - LC modelling: **finished**
 - Spectral analysis: **ongoing (2024) → finished (2025)**
 - Isochrone fitting: **pending (2024) → ongoing (2025)**

ParamID	A011-38	A012-49	A022-16	A024-61	A024-39	A030-24	A032-24	A045-07	A050-44	A082-16	A093-01	A095-05	A112-47	A115-07	A122-19	A125-31	A174-07	A204-14	A212-56
SPS (d)	0.445596008(38)	2.16024238(17)	0.909742344(50)	2.14004269(79)	0.46322956(85)	0.918209577(32)	3.9809940(4)	1.622220757(38)	0.75318049(16)	1.528492462(44)	0.897421205(87)	1.43915158(16)	0.51232371(11)	2.23919493(68)	2.51839426(46)	3.057040958(70)	0.50220323(40)	1.932692211(27)	0.702432506(31)
ST_OS (JD-2400000)	58354.498061(80)	58356.954219(93)	59447.821257(30)	58791.50006(40)	58386.38537(4)	58411.810372(19)	58412.191843(47)	54476.445872(75)	58411.4623(1)	54470.68495(14)	55210.67954(39)	58518.45786(17)	58571.07378(31)	59555.15673(1)	59309.10856(17)	53860.19815(10)	52911.2733(18)	52029.28052(11)	58325.345037(62)
ST_PS (JD-2400000)	51868.83933(31)	55938.0252(27)	56896.6736(13)	54399.6004(60)	57268.4913(16)	56189.51243(55)	56902.39839(24)	53277.22072(71)	55846.6940(23)	53368.26366(51)	55872.7490(31)	54099.9024(44)	53838.0139(45)	55801.7073(84)	5587.4276(21)	54163.37(24)	54930.5044(19)	54005.9461(87)	55871.3809(53)
SK_1S (km/s)	118.4(2.0)	98.42(49)	131.37(97)	59.9(2)	124.32(64)	70.34(28)	106.47(23)	84.2(1.1)	102.04(21)	127.62(96)	112.90(24)	157.8(2.8)	96.77(9)	63.82(20)	73.15(15)	131.6(3.3)	68.91(19)	128.8(1.2)	128.8(1.2)
SK_2S (km/s)	162.9(3.3)	100.26(61)	132.66(91)	112.8(1.7)	162.2(2.6)	118.84(49)	77.093(48)	107.21(20)	168.3(3.5)	104.11(15)	127.55(71)	114.02(36)	163.5(2.1)	98.50(18)	106.4(2.5)	86.92(16)	158.4(1.9)	119.7(1.9)	144.5(1.1)
Δ gamma_1S (km/s)	18.6(2.3)	9.58(39)	-24.27(76)	24.32(17)	21.4(5)	58.89(36)	2.640(34)	54.54(21)	29.7(1.0)	35.33(9)	22.58(43)	-35.45(24)	10.8(1.9)	(var)	3.04(12)	-12.30(14)	-28.9(1.4)	-18.32(18)	-12.81(63)
Δ gamma_2-gamma_1S (km/s)	0.0 (fix)	0.0 (fix)	0.0 (fix)	0.0 (fix)	0.0 (fix)	1.3(2.5)	1.74(62)	0.0 (fix)	-0.33(29)	0.0 (fix)	0.0 (fix)	0.0 (fix)	0.0 (fix)	0.0 (fix)	0.0 (fix)	0.0 (fix)	0.0 (fix)	0.0 (fix)	0.0 (fix)
SeS	0.0 (fix)	0.0 (fix)	0.0 (fix)	0.0 (fix)	0.0 (fix)	0.0 (fix)	0.0 (fix)	0.0 (fix)	0.0 (fix)	0.0 (fix)	0.0 (fix)	0.0 (fix)	0.0 (fix)	0.0 (fix)	0.0 (fix)	0.0014(5)	0.0 (fix)	0.0 (fix)	0.0 (fix)
Siomegas(S^1)(cgs)	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Srms_rfm RV1S (km/s)	5.8	0.96	0.63	0.76	2.17	2.19	0.12	0.61	2.09	0.68	1.41	0.36	7.14	0.60	0.26	0.11	9.48	0.79	2.08
Srms_rfm RV2S (km/s)	7.0	1.11	1.59	2.16	1.41	2.02	0.18	0.44	8.24	0.51	2.12	0.77	5.90	0.78	5.51	0.48	5.91	6.35	2.93
SqS	0.729(19)	0.9817(77)	0.9903(10)	0.531(8)	0.766(13)	0.9916(55)	0.91362(68)	0.9941(28)	0.500(12)	0.9801(25)	1.0005(94)	0.9902(38)	0.965(21)	0.9824(20)	0.600(14)	0.8416(23)	0.831(23)	0.576(9)	0.891(11)
SM_1sin^3(i)S (MS_1dot)S	0.595(27)	0.886(12)	0.872(14)	0.747(25)	0.639(22)	0.6334(57)	0.6921(9)	0.8228(35)	0.837(41)	0.7007(25)	0.7723(105)	0.8754(58)	0.896(28)	0.8714(33)	0.805(43)	0.7055(30)	0.693(23)	0.852(31)	0.785(14)
SM_2sin^3(i)S (MS_1dot)S	0.433(17)	0.870(10)	0.863(14)	0.397(8)	0.490(10)	0.6280(53)	0.6323(6)	0.8171(38)	0.419(15)	0.6688(30)	0.7727(124)	0.8669(46)	0.864(33)	0.8561(22)	0.483(15)	0.5937(26)	0.576(29)	0.491(10)	0.699(14)
Saisin(i)S (RS_1dot)S	2.478(34)	8.486(33)	4.749(24)	7.310(71)	2.624(25)	4.297(12)	11.6117(44)	6.853(10)	3.759(55)	6.230(8)	4.527(21)	6.457(12)	6.254(36)	8.645(9)	8.48(13)	9.675(15)	2.879(38)	7.026(74)	3.794(23)
sr_1S	0.247(62)	0.1186(15)	0.1856(14)	0.1440(18)	0.2642(20)	0.1581(33)	0.0609(14)	0.1239(59)	0.2420(21)	0.1162(13)	0.1731(21)	0.1735(44)	0.270(85)	0.1052(56)	0.08699(56)	0.07187(51)	0.244(10)	0.1192(10)	0.2228(19)
sr_2S	0.1793(120)	0.1032(18)	0.1838(16)	0.0613(5)	0.1895(19)	0.1466(34)	0.0518(20)	0.1195(63)	0.1091(7)	0.1095(14)	0.1747(25)	0.1718(46)	0.2787(105)	0.1001(131)	0.05492(44)	0.05024(52)	0.219(9)	0.06758(37)	0.1897(33)
SIS (S^1)(cgs)	79.7(1.1)	86.73(18)	87.98(26)	89.94(26)	86.12(53)	85.58(22)	87.37(16)	85.35(12)	88.08(37)	89.12(11)	86.65(30)	84.66(46)	82.00(33)	89.21(10)	89.44(18)	82.81(5)	88.80(12)	86.88(29)	86.88(29)
SIStablefoot(mark)c	0.548(20)	0.984(40)	1.020(35)	0.1146(69)	0.457(13)	0.995(31)	0.730(32)	0.909(30)	0.1418(84)	0.888(25)	0.977(33)	0.98(4)	0.86(10)	0.915(51)	0.242(15)	0.5067(17)	0.381(43)	0.2228(79)	0.755(104)
slf_2d_11^CS	0.273(52)	0.737(49)	1.006(45)	0.0200(13)	0.234(9)	0.805(52)	0.542(55)	0.83(18)	0.0284(19)	0.802(27)	0.997(43)	0.97(11)	0.80(14)	0.823(64)	0.0950(33)	0.2451(56)	0.258(52)	0.0741(11)	0.525(37)
slf_3d_11^CS	0.317(42)	0.358(14)	0.074(24)	0.0 (fix)	0.199(21)	0.0 (fix)	0.0 (fix)	0.078(11)	0.447(15)	0.149(8)	0.0 (fix)	0.0 (fix)	0.026(34)	0.0 (fix)	0.0 (fix)	0.060(23)	0.0 (fix)	0.0 (fix)	0.0 (fix)
Srms_rfm LC1S (mmag)	1.42	1.48	3.04	1.65	1.93	1.13	0.910(60)	1.68	0.87	1.31	2.87	1.43	1.85	1.41	1.75	1.27	517/79/23	1.24	2.33
SM_1S (MS_1dot)S	0.625(29)	0.890(12)	0.873(14)	0.747(25)	0.644(22)	0.6390(58)	0.6943(10)	0.8310(36)	0.838(41)	0.7010(25)	0.7765(105)	0.8869(62)	0.923(30)	0.8717(33)	0.805(43)	0.7060(30)	0.710(26)	0.853(31)	0.788(15)
SM_2S (MS_1dot)S	0.454(18)	0.874(10)	0.865(14)	0.397(8)	0.493(10)	0.6337(54)	0.6343(7)	0.419(15)	0.6870(30)	0.7769(125)	0.8783(51)	0.891(34)	0.8563(22)	0.483(15)	0.5942(26)	0.590(30)	0.491(10)	0.703(14)	0.703(14)
Sas (RS_1dot)S	2.519(36)	8.500(33)	4.752(24)	7.210(71)	2.630(25)	4.310(12)	11.6239(46)	6.876(10)	3.761(55)	6.23(8)	4.536(21)	6.485(13)	3.287(36)	8.646(9)	8.48(13)	9.678(13)	2.902(41)	7.206(74)	3.800(23)
SR_1S (RS_1dot)S	0.623(18)	1.008(13)	0.882(6)	1.052(165)	0.6849(84)	0.681(14)	0.708(16)	0.951(41)	0.910(15)	0.724(8)	0.785(10)	1.125(29)	0.917(30)	0.910(5)	0.737(12)	0.6855(50)	0.708(32)	0.857(11)	0.847(9)
SR_2S (RS_1dot)S	0.452(31)	0.877(16)	0.873(19)	0.4481(56)	0.5010(69)	0.602(23)	0.602(23)	0.410(7)	0.682(9)	0.792(12)	1.115(30)	0.916(36)	0.865(11)	0.468(8)	0.4862(51)	0.638(28)	0.487(6)	0.721(13)	0.721(13)
Slog(a_1)S	4.646(24)	4.381(11)	4.489(7)	4.267(12)	4.563(10)	4.577(10)	4.580(20)	4.498(41)	0.443(12)	4.564(9)	4.539(11)	4.284(22)	4.479(27)	4.461(5)	4.609(12)	4.603(6)	4.589(38)	4.501(10)	4.480(8)
Slog(a_2)S	4.786(59)	4.494(15)	4.493(8)	4.734(7)	4.732(9)	4.699(20)	4.681(34)	4.425(46)	0.433(8)	4.607(11)	4.531(13)	4.288(23)	4.464(34)	4.496(11)	4.786(7)	4.439(9)	4.601(38)	4.754(5)	4.569(16)
Sv_rfm rot.1S (km/s)^2 [svoch]	70.7(2.0)	23.60(31)	49.03(44)	24.88(39)	75.9(9)	37.5(8)	8.99(21)	26.5(1.3)	61.1(1.0)	23.96(25)	44.25(56)	39.5(1.0)	90.5(2.9)	20.55(11)	14.81(24)	11.51(8)	71.3(3.2)	22.49(30)	60.96(64)
Sv_rfm rot.2S (km/s)^2 [svoch]	51.2(3.5)	20.54(37)	48.59(49)	10.59(13)	54.7(7)	34.8(8)	7.65(30)	25.6(1.4)	27.56(44)	22.58(30)	44.66(67)	39.2(1.1)	90.4(3.5)	19.55(26)	9.35(16)	8.04(8)	64.1(2.8)	12.75(15)	51.90(96)
ST_rfm eff.1S (K)	3750(250)	5335(55)	5615(320)	5590(100)	5240(190)	4695(65)	4840(70)	5250(150)	5410(130)	4860(40)	5460(100)	5790(160)	4740(80)	5280(50)	5180(45)	4830(65)	5040(90)	5060(45)	4980(60)
ST_rfm eff.2S (K)	3085(300)	5300(85)	5430(470)	---	---	4720(55)	4440(80)	4680(140)	---	4680(40)	5530(160)	5800(150)	4760(90)	5275(35)	---	4890(170)	4670(21)	---	4750(90)
ISMHS1S_1S (dex)	---	0.01(5)	0.31(41)	-0.10(9)	-0.41(21)	-0.20(7)	-0.32(9)	0.09(11)	-0.14(11)	-0.24(6)	-0.71(13)	-0.54(10)	-0.10(3)	---	-0.08(5)	0.01(7)	-0.59(10)	---	-0.04(5)
ISMHS1S_2S (dex)	---	0.03(8)	0.35(41)	---	---	-0.26(9)	-0.22(11)	-0.17(17)	-0.14(6)	-0.49(17)	-0.67(11)	-0.51(12)	-0.14(4)	---	0.02(26)	0.02(17)	-0.80(47)	---	-0.21(12)
S[alpha]HS1S_1S (dex)	---	0.14(6)	0.0 (fix)	-0.01(13)	0.0 (fix)	0.0 (fix)	0.0 (fix)	0.0 (fix)	0.0 (fix)	0.0 (fix)	0.11(6)	0.10(10)	0.09(2)	0.35(3)	0.24(4)	0.44(5)	0.31(3)	0.0 (fix)	0.0 (fix)
S[alpha]HS1S_2S (dex)	---	0.15(9)	0.0 (fix)	---	---	0.38(3)	0.0 (fix)	0.0 (fix)	0.0 (fix)	0.0 (fix)	0.10(14)	0.18(7)	0.22(2)	---	0.24 (fix)	0.46(16)	---	0.0 (fix)	0.0 (fix)
Sv_rfm mic.1S (km/s)	---	1.88(18)	1.1(0.8)	1.59(35)	0.57(40)	2.44(37)	1.44(30)	3.68(68)	1.85(46)	2.00(23)	0.92(47)	1.80(43)	3.28(51)	1.76(9)	1.77(21)	2.09(33)	1.29(42)	2.04(18)	1.96(23)
Sv_rfm mic.2S (km/s)	---	1.47(28)	3.0(1.9)	---	---	1.81(38)	1.78(45)	1.17(74)	---	2.04(27)	0.92(35)	2.15(43)	1.71(55)	1.77(11)	---	1.5(1.4)	1.7(2.2)	---	1.57(56)
Sv_rfm mac.1S (km/s)	---	3.10	3.23	3.70	3.47	3.64	3.47	2.95	3.35	3.46	3.56	4.97	3.58	3.18	3.15	3.49	3.73	3.17	3.36
Sv_rfm mac.2S (km/s)	---	3.04	2.81	---	---	3.62	4.06	3.31	---	3.66	3.82	4.96	3.56	3.22	---	3.55	3.67	---	3.57
Sv_rfm rot.1Ssin(i)S (km/s)	---	23.9(7)	49.1(3)	27.3(1.3)	79.2(6.6)	35.4(1.2)	10.4(7)	27.6(2.0)	59.8(2.9)	27.6(8)	46.0(2.4)	39.4(2.0)	81.6(4.2)	21.1(3)	17.04(66)	13.8(8)	65.3(2.8)	23.7(6)	61.4(1.6)
Sv_rfm rot.2Ssin(i)S (km/s)	---	22.4(1.1)	50(9)	---	---	36.0(1.2)	9.2(1.1)	30.9(2.6)	---	26.1(9)	47.9(3.0)	40.3(1.8)	82.5(4.6)	21.1(4)	---	17.2(3.4)	63(11)	---	49.3(2.5)
SNRS_rfm sp.1S	---	35	145	100	200	200	200	100	85	35	105	175	180	205	160	100	205	155	165
SNRS_rfm 2S	---	75	35																

THANK YOU

...and remember:

**WE ARE CLOSER TO J2050
THAN TO J2000**