

Science with SALT

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Programmes

- ▶ 2011-3-POL-003 [WR] star in a close binary system
- ▶ 2012-1-POL-010 Spectroscopic observations of new binary central stars of planetary nebulae
- ▶ 2012-2-POL-006 New planetary nebulae in the Magellanic Clouds

(all RSS longslit proposals)

Spectroscopic observations of new binary central stars of planetary nebulae

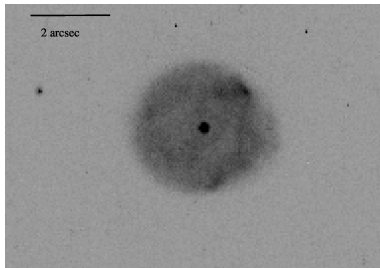


Figure: HST image of the PN H 2-25

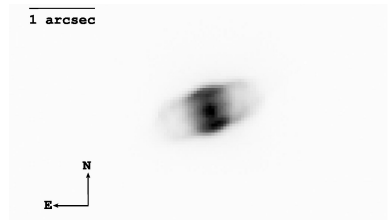


Figure: HST image of the PN He 2-260

Lightcurves of the CSPNe

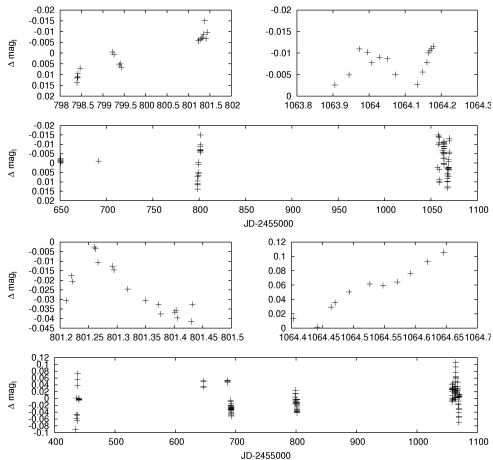
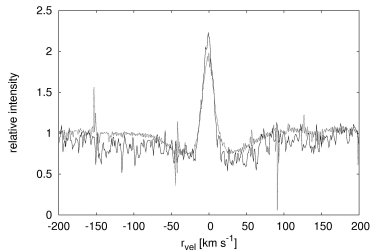
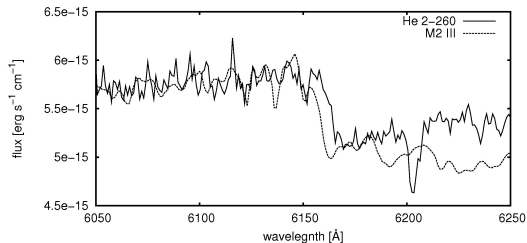


Figure: SAO photometry of the PN H 2-25 and He 2-260

Possible artifact

- ▶ Spectral feature near the TiO 6150Å band detected, shifted with respect to the nebular velocity by 250 km s^{-1}
- ▶ No other bands detected
- ▶ Hydrogen/helium absorption lines do not show any significant shift



Comparison of fluxes of the strongest nebular lines for H 2-25.

λ [Å]	ion	ESO 1.52m ^a 1984-04-30 2445820	ESO 1.52m ^b 2001-05-20 2452091	SALT 2012-08-21 2456076
4861	H β	100.0	100.00	100.0
4959	[O III]	-	24.6	30.1
5007	[O III]	58	75.5	95.3
5754	[N II]	-	2.6	3.0
5875	He I	-	37.4	37.6
6300	[O I]	-	3.6	
6312	[S III]	-	4.8	3.0
6364	[O I]	-	-	
6548	[N II]	196	167.3	137.8
6563	H I	1522	1649.2	1547.8
6584	[N II]	598	528.5	419.9
6678	He I	-	18.7	18.3
6716	[S II]	21	20.8	16.3
6731	[S II]	46	20.6	26.5
7002	[O I]	-	0.9	
7065	He I	-	27.4	27.6
7135	[Ar III]	71	53.6	51.0
7320	[O II]	73 ^d	50.8	51.3
7330	[O II]	73 ^d	45.9	41.2

^aAcker et al. (1991) ^bEscudero (2004) ^dblend of the 7320 and 7330 Å lines

Comparison of fluxes of the strongest nebular lines for He 2-260.

λ [Å]	ion	ESO 1.52m ^a 1984-04-30 2445820	ESO 1.52m ^b 2001-07-01 2452091	VLT 2005-04-20 2453480	SAAO 1.9m 2012-05-07 2456054	SALT 2012-05-29 2456076
4861	H β	100.0	100.00	100.0	100.0	100.0
4959	[O III]	-	1.6	1.8	2.6	2.4
5007	[O III]	-	5.1	5.5	7.8	7.9
5754	[N II]	3.0	4.1	4.1	4.1	4.2
5875	He I	4.0	2.1	2.8	2.9	2.9
6300	[O I]	5.0	3.5	3.4	3.7	3.4
6312	[S III]	-	1.3	1.4	2.0	1.5
6364	[O I]	2.2:	1.1	1.1	1.1	1.1
6548	[N II]	77.0	59.6	57.8	61.8	62.9
6563	H I	581.0	498.9	508.9	492.6	493.3
6584	[N II]	213.0	183.8	190.0	179.3	185.9
6678	He I	-	0.5	-	1.4	0.8
6716	[S II]	4.0	4.2	-	4.2	3.6
6731	[S II]	10.0	9.0	-	8.0	8.1
7002	[O I]	-	0.9 ^c	-	0.9	0.7
7065	He I	-	1.1	-	1.9	1.9
7135	[Ar III]	-	1.6	-	2.1	2.3
7320	[O II]	80 ^d	35.8	-	44.8	49.8
7330	[O II]	80 ^d	41.2	-	39.5	40.4

^aAcker et al. (1991) ^bEscudero (2004) ^cmisidentified as [Ar v] λ 7005.6 by Escudero (2004)

^dblend of the 7320 and 7330 Å lines

Ion stratification in a PN

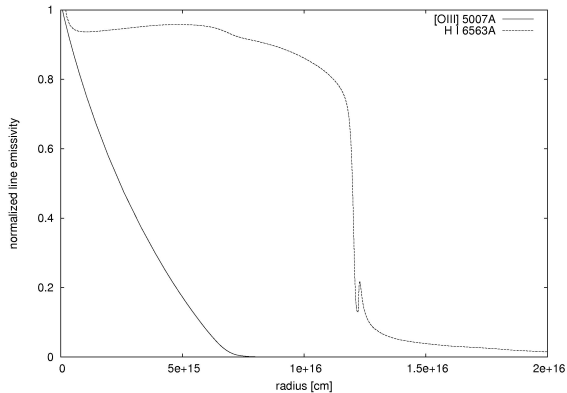


Figure: Radial plot of the emissivity of the [O III] 5007Å line compared with the H α line

Evolutionary tracks for post-AGB stars

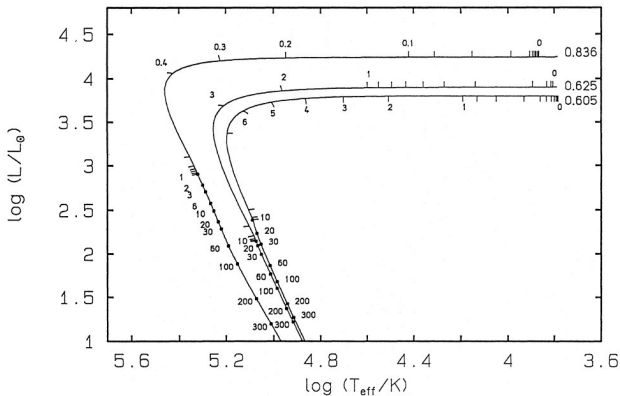


Figure: Evolutionary tracks for different masses by Blöcker (1995)

Evolution of the emission line fluxes in He 2-260

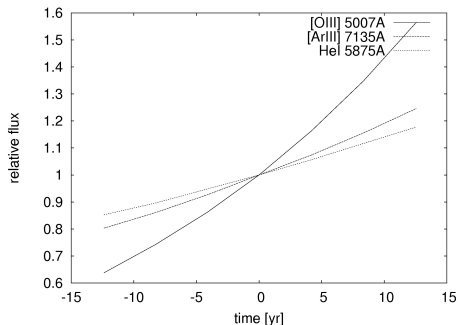


Figure: Predicted evolution of the nebular line fluxes for the PN He 2-260 modelled with the Cloudy code (Ferland, 1998)

Heating rate vs mass of the central star

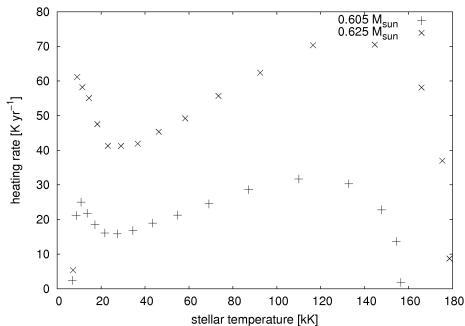
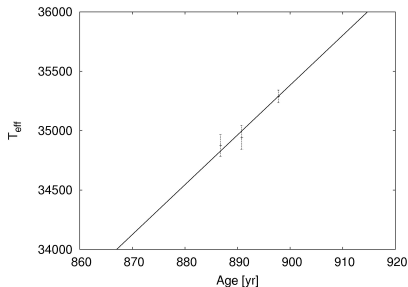


Figure: Comparison of the heating rate for two different masses

Fitting the evolutionary models

- ▶ $0.622^{+0.004}_{-0.006} M_{\odot}$ using the evolutionary track by Blöcker (1995) or $0.638^{+0.007}_{-0.009} M_{\odot}$ using Vassiliadis & Wood (1993)
- ▶ The age of the central, spherical component of the nebula, of about 1000 years is in better agreement with the post-AGB evolutionary track by Blöcker (1200 years) than Vassiliadis & Wood (550 yr)



Variable PN candidates in the SMC (I mag from 16.6 to 19.6)

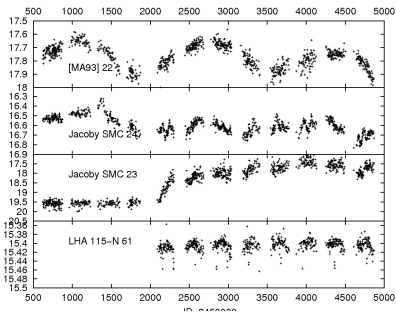
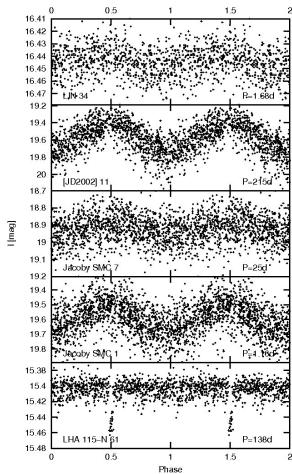


Figure: OGLE II and III photometry of the SMC PNe

Spectroscopy of the variable stars

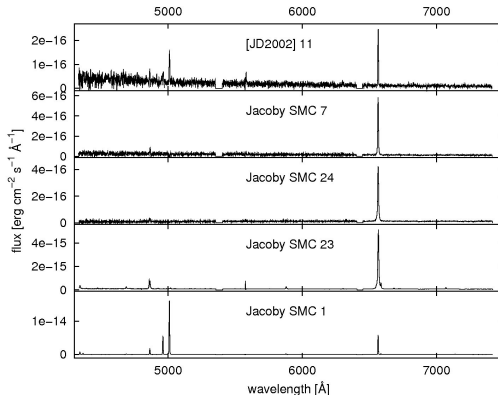


Figure: SALT spectroscopy of selected SMC variables

Spectra of Jacoby SMC 1

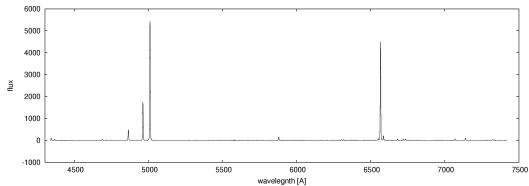


Figure: SALT spectroscopy of Jacoby SMC 1 (two 1200s spectra)

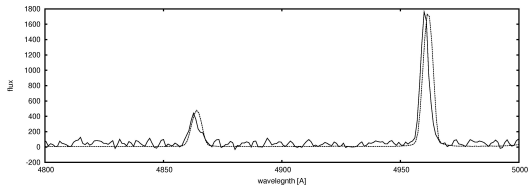


Figure: Close-up at the H β spectral region

Summary

- ▶ [O III] 5007Å line flux change observed in a young PN He 2-260 on a timescale of a decade
- ▶ Heating rate determined and mass of the central star interpolated from the evolutionary tracks
- ▶ Variability of He 2-260 and H 2-25 due to pulsations rather than binarity (Zalewski, 1993; Gautschy, 1993; Handler, 2003)
- ▶ First binary central star of a PN in the SMC confirmed
- ▶ Relative flux calibration on SALT seems to be reliable

Bibliography

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