

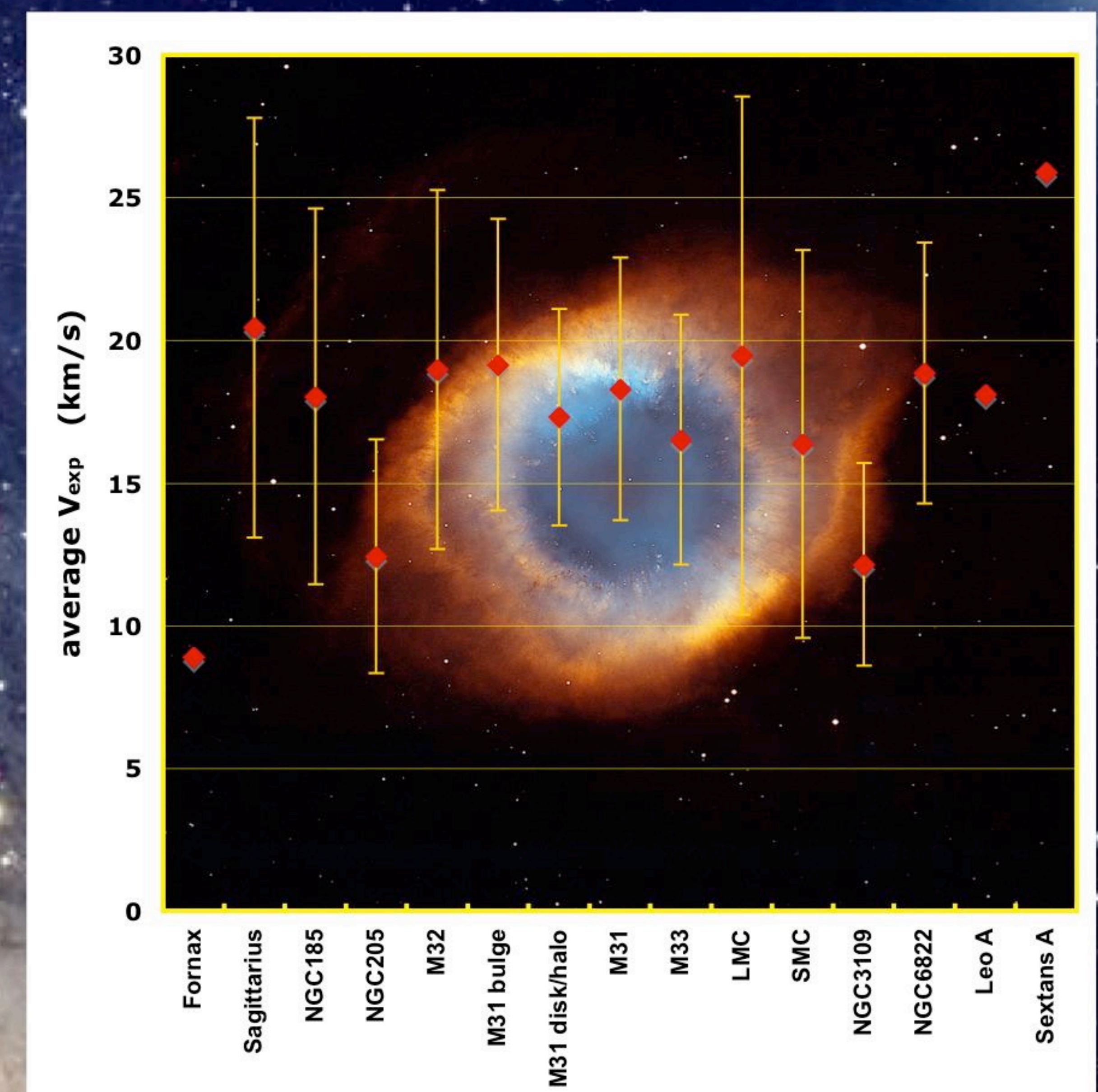
Uniformity Despite Diversity: PN expansion velocities in the Local Group

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We have undertaken a survey of planetary nebula (PN) expansion velocities in Local Group galaxies visible from the OAN-SPM, Mexico using the MES (Meaburn et al. 2003, RMAA, 39, 185) on the 2.1m telescope. In the configuration used, the instrumental profile has a velocity width of 11.5 km/s (2.7 pix. FWHM) in the line of [O III] λ 5007. We observe PNe within 2 mag of the peak of the PN luminosity function for galaxies as distant as NGC 3109 (~1.3 Mpc). The line profiles below cover the entire range of expansion velocities that we measure, all of which are resolved. For the brightest of these unresolved objects, asymmetries in the line profile are clear, e.g., PN1 in NGC 185, indicating that either the matter or velocity distributions are not isotropic.

By far, the most surprising result is that the expansion velocities are remarkably uniform, despite the PN populations in different galaxies arising from very different stellar populations. Even the range of expansion velocities measured in different galaxies tend to be similar. In M31, where we observe PNe sampling the bulge, halo, and outer disk, no significant difference is found among the expansion velocities. NGC 205 and NGC 3109 stand out for having mean PN expansion velocities rather different from the others.

The O²⁺ zone could sample different parts of the nebular shell in objects arising from very different stellar populations, but this is unlikely to be a severe problem because we observe the PNe that are brightest in [O III] λ 5007, where the O²⁺ zone encompasses the majority of the mass of the nebula.



The red dots represent the mean expansion velocity for the PN population while the error bars represent the standard deviation of the expansion velocity distribution. The dots without error bars represent the velocity for a single PN. We adopt half of the FWHM of a single gaussian fit to the line profile as our measure of the expansion velocity. We have converted the data of Dopita et al. (1985, ApJ, 296, 390) and Dopita et al. (1988, ApJ, 327, 639) for the Magellanic Clouds to the system used for all other data. The velocities are corrected for the instrumental profile, but not thermal broadening.

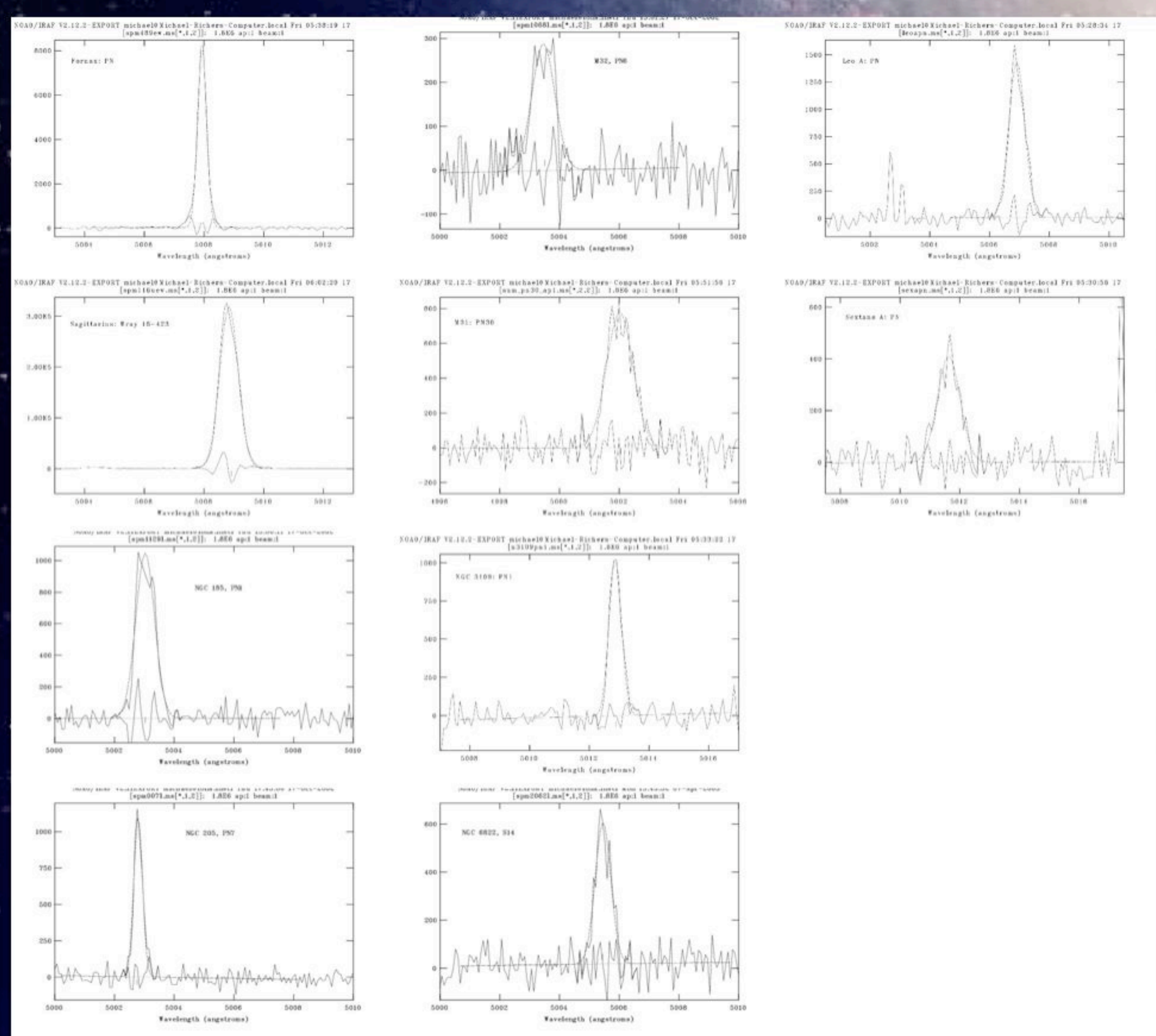


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M31 & companions: T.A.Rector
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These plots present the line profiles, a single component gaussian fit to the line profile, and the residual from this fit for a single PN in each of the ten Local Group galaxies in which we have observed PNe.

galaxy	count	min	max	average	std. dev.
Fornax	1			8.9	
Sagittarius	3	12.9	27.6	20.4	7.4
NGC185	4	9.5	24.5	18.0	6.6
NGC205	7	7.3	16.9	12.4	4.1
M32	7	11.5	26.4	19.0	6.3
M31 bulge	28	10.5	30.6	19.1	5.1
M31 disk/halo	24	10.9	26.8	17.3	3.8
M31 total	52	10.5	30.6	18.3	4.6
M33	33	8.7	26.4	16.5	4.4
LMC	93	2.8	67.0	19.5	9.1
SMC	35	6.4	33.4	16.4	6.8
NGC3109	7	7.7	17.1	12.1	3.5
NGC6822	4	16.0	25.6	18.9	4.6
Leo A	1			18.1	
Sextans A	1			25.9	