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Distances to Planetary Nebulae Using Astrometric Data of Gaia DR2

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Abstract

The present work is dedicated to deriving the distances of Galactic planetary nebulae using the parallax measurements of Gaia Data Release 2 (DR2). By applying an accurate calibrating sample of distances derived from Gaia DR2, we aim to examine the consistency between Gaia DR2 trigonometric distance and prior trigonometric distances as well as other individual methods usually used for distance determination. We started by searching the literatures for confirmed planetary nebulae (PNe), known up to this time, followed by discussing the method used for selecting PNe central stars from Gaia DR2. We were able to identify 2170 Gaia DR2 sources classified as PNe, from which we ignored all sources with negative parallax values, unmeasured parallax, and unmeasured colours. Only true CSs with parallax uncertainties less than 25% were adopted. As a result, a sample composed of roughly 200 PNe with highly accurate parallax measurements was selected. By comparing Gaia DR2 trigonometric distances with the previous ground-based trigonometric distances and those obtained by the Hubble Space Telescope we found that: (1) The ground-based trigonometric distances obtained by Pottasch (1996) [1] and Gutiérrez-Moreno and his colleagues (1999) [15] perfectly matched Gaia DR2 distances. However, the trigonometric distances given by Harris and his colleagues (2007) [5] show somewhat smaller values; (2) The space-based distances, using HST [16], are slightly higher than that of Gaia DR2 with an average ratio of 1.1. By comparing Gaia DR2 trigonometric distances with other individual distance methods we concluded that the spectroscopic method is the best subsequent method for determining the PN distance after the trigonometric method. Applying other methods should take with care especially the gravity method.

Keywords: Distances; Gaia DR2; Planetary nebulae; general.

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1. Introduction

The major difficulty that faces many of planetary nebulae (PNe) studies is their unreliable distances. This strong handicap obstructs astronomers from finding a trustworthy solution for some PNe quantities, such as the Galactic chemical gradients and the formation rate [1, 2]. During the past decades, many efforts have been made to find methods of PNe distances determination, but the accurate distances are known for a sufficiently small number of PNe. In general, the methods used to determine the PNe distances are classified into statistical and individual methods. The statistical methods are divided into two groups. The first group assumes that one of PNe parameters is constant for all PNe at every stage of their evolution. The pioneer method of this group was developed by Shklovsky (1956) [3] who assumed all PNe have approximately the same ionized mass.The second group relies on an empirical relation between two nebular parameters one of which to be distance-dependent, e.g. radio surface brightness versus nebular radius. On the other hand, the individual method can be used as independent ways to determine distances of PNe. General speaking, the individual methods are more accurate than statistical ones, but their applicability are limited to a handful PNe. The known individual methods providing reliable distances for PNe are the trigonometric parallax, spectroscopic parallax for a companion of the PN central star, cluster membership, reddening (extinction), angular expansion and gravity. Some of these methods are more accurate than others and each one of them has its own assumptions and limited applications [4]. The trigonometric parallax is the direct and most precise way used to determine the distance for only nearby object. unfortunately, the numbers of PNe with measured trigonometric distance prior to the Gaia era were very few [5,6,7]. This long-standing problem is about to be solved with the recent and upcoming space-based trigonometric parallax measurements of Gaia mission, at least for nearby planetary nebulae. Currently, Gaia mission provides the parallax measurements for ~ 1.7 billion stars. Not only the extracted Gaia parallaxes increase the number of PNe with trustful distances but can also be used to test the quality and precision of other methods usually applied to derive the distances of individual PNe. The main goals of the present work are to: (1) Extract the parallax measurements for the central stars of planetary nebulae using the second Data Release of Gaia "Gaia DR2" (2) Examine the consistency between Gaia DR2 trigonometric distances and prior trigonometric distances (3) Discuss the comparison between Gaia DR2 trigonometric distance and other individual distance methods. The article is structured as follows: Sect. 2 introduces the data sample. Extracting central star Gaia DR2 parallaxes is given in Sec. 3. Gaia DR2 trigonometric distances versus prior trigonometric distances are presented in Sect. 4 The Comparison between Gaia trigonometric distances and other individual distances methods is discussed in Sect. 5, while the conclusions are given in the last section.

2. Database catalogues

2.1 sample selection

We prepare two data samples of planetary nebulae. The first sample "Sample I" contains all PNe whose central stars (CSs) have been spectroscopically confirmed as PN ionizing star (~ 560 PNe) [8,9,10,11,12]. Since this sample includes a small fraction of observed PNe, we extract a second sample "Sample II" from the Hong Kong/AAO/Strasbourg Hα (HASH) planetary nebula catalogue [13]. Currently, this is the largest catalogue of Galactic PNe containing ~ 3500 true, likely, and possible PNe. The second sample includes only the true PNe in the HASH catalogue (~ 2480 PNe). Most of the nebulae in “sample I” are involved in “Sample II”. The purpose of providing “Sample I”, although it has less PNe than sample II, is that their members are confirmed CS. On contrary to Sample I, not all nebular central stars in Sample II were detected or their photometric and spectroscopic parameters were measured.

2.2 PN central star colour

The CS is the source of the UV radiation that ionizes the nebula; therefore, it must appear as a blue star and lies at or very close to the PN centre. Reviewing the photometric catalogues of PNe, few CSs appear as red stars $(B - V \geq 0.0)$ [14]. This attribute to high reddening in the line of sight to the PN or internal to the nebula itself, or due to visible light being dominated by a main sequence close binary companion. We notice that most of the true red CSs in Gaia DR2 $(BP - RP > 0.0)$ are associated with high flux excess factors, which frequently refer to inaccuracy in determining the blue and red photometric magnitudes.

2.3 Searching Gaia DR2 for PN central stars

1. We search the Gaia DR2 sources[a] that match PNe equatorial coordinates of all objects in Sample I and Sample II. A search is applied through circles of 0.5, 1.0, 2.0, 5.0, and 10.0 arcsec size centred on each PN. We use such big circles because the coordinates of extended PNe in old catalogues and PNe interact with ISM are often not centred on the central star. Frequently, the true CS lies exactly at the PN centre or within an angular distance less than 2.0 arcsec.
2. We reject all Gaia DR2 sources with negative parallax, unmeasured parallax, and unmeasured colours.
3. Since all sources in Sample I are confirmed CSs, we adopt all central stars even if they appear as red stars. For the CSs in Sample II, we ignore the red stars following the results of these four steps: (I) Check the uncertainties of BP and RP magnitudes. (II) Search for blue star lies within the nebular central area. (III) Inspect literature for another photometric measurements confirm the reality of the CS. (IV) Check the flux excess factor of the star. Based on the result of these steps we decide if it is a true central star or not.
4. We perform visual inspection for the matched Gaia sources through the Simbad database[b] and its associated Aladin Lite[c] preview.

3. Extracting central star Gaia DR2 parallaxes

The Gaia DR2 sources matching the criteria for true PNe central stars are 504 in Sample I and 1666 in Sample II. However, many matched sources have negative parallaxes values, no parallaxes at all, and miss colours. To obtain a target sample of CSs with high confidence trigonometric distances, all CSs with parallax uncertainties larger than 25% are ignored. The final sample is composed of 200 objects and given in the appendix. Table 1

[a] https://gea.esac.esa.int/archive/

[b] http://simbad.u-strasbg.fr/simbad/

[c] ***Aladin*** is an interactive sky atlas allowing the user to visualize digitized astronomical images or full surveys, superimpose entries from astronomical catalogues or databases, and interactively access related data and information from the ***Simbad database***.

and 2 summarize the search results of Gaia DR2 sources that matched the CSs of planetary nebulae in Sample I and Sample II.

Table 1: Search results in Gaia DR2 database for the CSPNe – Sample I

	0.5 arcsec	1.0 arcsec	2.0 arcsec
Total	418	461	504
No parallax measurements	42	47	63
Negative parallax	53	58	66
No colour	21	22	24
Blue and Red stars	302	334	351
Blue: Parallax < 25%	89	91	93
Parallax: 25% - 50%	30	35	37
Parallax > 50%	13	18	18

Table 2: Search results in Gaia DR2 database for the CSPNe in HASH catalogue – Sample II

	0.5 arcsec	1.0 arcsec	2.0 arcsec
Total	796	1097	1666
No parallax measurements	147	250	478
Negative parallax	140	190	310
No colour	57	78	146
Blue and Red stars	452	579	732
Blue: Parallax < 25%	56	59	63
Parallax: 25% - 50%	30	37	40
Parallax > 50%	27	39	49

4. Gaia DR2 trigonometric distances versus prior trigonometric distances

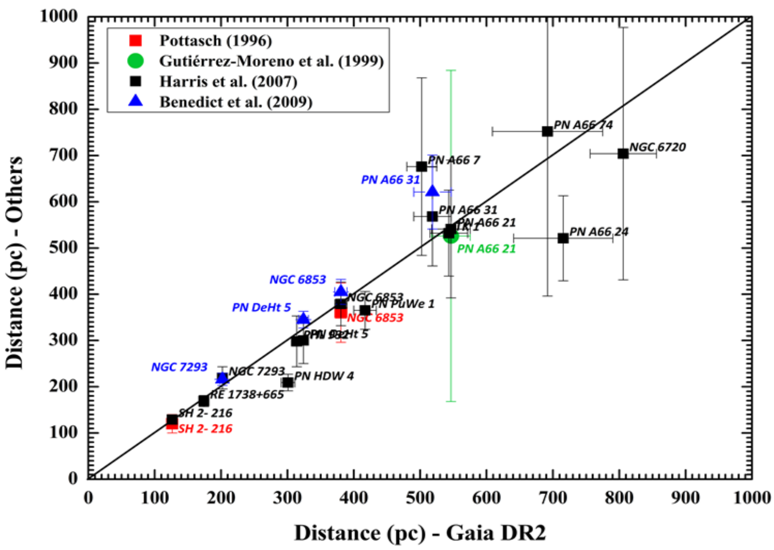

Figure 1: Comparison between the Gaia DR2 trigonometric distances and prior trigonometric distances. The diagonal solid line represents the one-to-one correlation.

There are several PNe in Gaia DR2 whose trigonometric parallaxes have been already measured either from the ground or from space. Gutiérrez-Moreno and his colleagues (1999) [15] presented ground-based parallaxes for three nebulae, one of which has parallax measurement in Gaia DR2 (PN A66 21). By comparing the Gutiérrez-Moreno and his colleagues (1999) [15] and Gaia DR2 distances, an almost 1:1 match is found. However, Gutiérrez-Moreno and his colleagues (1999) [15] distance error is ~ 12 times that of Gaia DR2. Further, Ground-based parallaxes for NGC 6853 and SH 2- 216 were obtained by Pottasch (1996) [1]. Both PNe distances are compatible with those of Gaia DR2 but their errors greatly reduced in Gaia DR2. Using the astrometry of US Naval Observatory, Harris and his colleagues (2007) [5] provided ground-based parallaxes for 16 PNe. All these PNe but one are given in Gaia DR2. The PNe trigonometric distances of Harris and his colleagues (2007) [5] show somewhat smaller values, except few objects, than Gaia DR2 with an average ratio of 0.97. The distances amusements of Harris and his colleagues (2007) [5] display high uncertainties compared to those of Gaia DR2. The overall distance error of Gaia DR2 is ~ 3% while it is ~ 17% for that of Harris and his colleagues (2007) [5]. Later, Four PNe from Harris and his colleagues (2007) [5] list have been observed for 3.8 years by Hubble Space Telescope (HST; [16]). The four objects are identified in Gaia DR2. The HST provides slightly higher distances than Gaia DR2 with an average ratio of 1.1. However, the uncertainties in the HST measurements are marginally higher than that of Gaia DR2. Figure 1 displays the trigonometric distance of Gaia DR2 versus the prior trigonometric measurements. To summarize the study given here, the Gaia DR2 distances show nearly perfect agreement with the previous trigonometric distances. The correlation coefficients between distances of Gaia DR2 and the others range from 0.92 - 1.0

5. Comparison between Gaia DR2 trigonometric distances and other individual distances methods

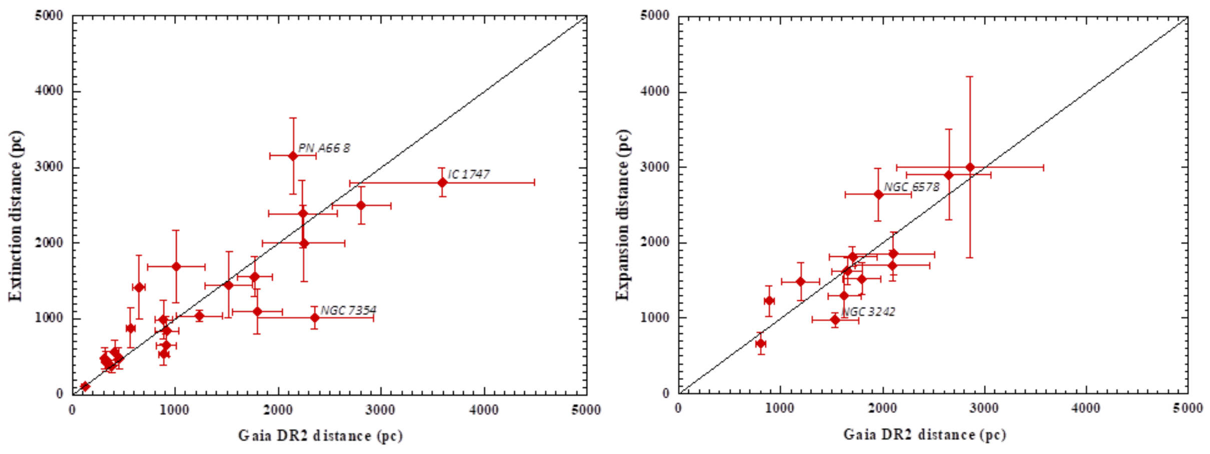

Figure 2: Comparison between the Gaia DR2 trigonometric distances and distances derived from both the extinction method (left panel) and expansion method (right panel). The diagonal solid line as defined in Figure 1.

The last few decades several individual methods, besides the trigonometric method, have been used to determine the PNe distances (see section 1). For a description of these various methods, their assumption, uncertainties and limitation, the reader is referred to [4]. In fact, the trigonometric is the only direct method for distance determination. Other methods have to be applied under particular assumptions. Therefore, it is useful to compare the different individual methods with the trigonometric method in order to investigate the consistency between these methods. Extracting the PNe distances from different individual methods is provided in [17]. In that paper, the authors noted variation in distance values of a certain PN among different references. The variation was found to be caused by different authors where the same method was used. To overcome this problematic issue, the authors derived a reliable weighted mean distance for each object. A comparison between the extinction and trigonometric methods, for 23 common PNe, is presented in Fig. 2 (left panel), where the diagonal solid line represents the one-to-one correlation. In general, the comparison reveals a good correlation between both methods, where the correlation coefficient (r) is 0.84. The mean and median distance ratios $\langle {}^{D_{Ext}}/_{D_{Tri}} \rangle$ are 1.08 and 0.95, respectively. Although the majority of the objects have comparable distances within the error range, there are few outliers such as PN A66 8 and NGC 7354. Figure 2 (right panel) displays a comparison between the expansion and trigonometric methods for 13 common objects. The figure declares a well correlation between both methods, where the correlation coefficient (r) is 0.87. The mean and median distance ratios $\langle {}^{D_{Exp}}/_{D_{Tri}} \rangle$ are 1.0 and 0.98, respectively. In general, the expansion distances are much closer to

the trigonometric distances than the extinction distances, but there are also few outliers, e.g., NGC 6578 and NGC 3242.

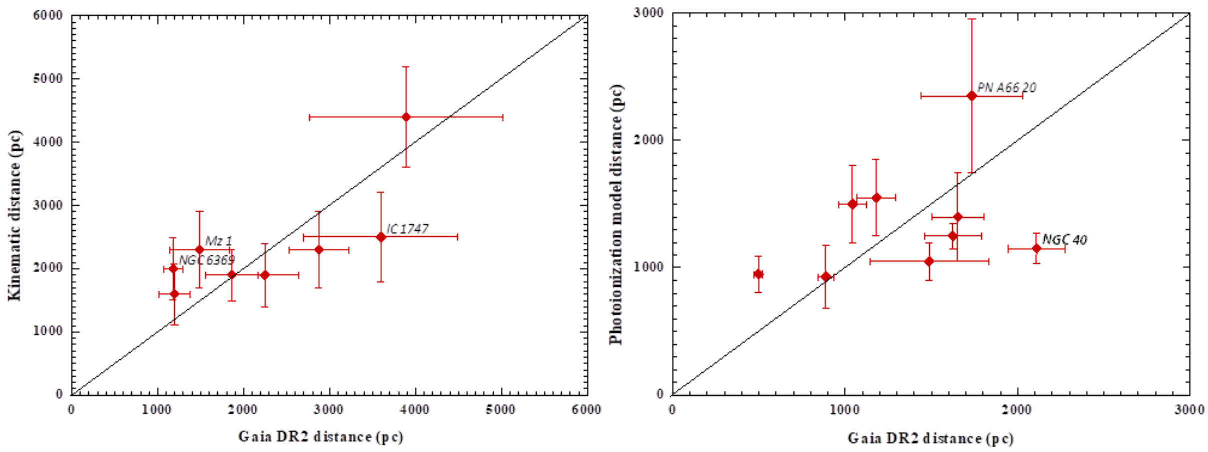

Figure 3: Comparison between the Gaia DR2 trigonometric distances and distances derived from the kinematic method (left panel) and photoionization method (right panel). The diagonal solid line as defined in Figure 1.

In Fig. 3 (left panel), we compare the distances derived from the kinematic and trigonometric methods. The figure illustrates inconsistent distances for seven of eight objects although the correlation coefficient is still good (r = 0.76). The mean (1.13) and median (1.08) ratios $\langle {}^{D_{Kin}}/_{D_{Tri}} \rangle$ between both methods give slightly higher kinematic distances compared to trigonometric distances. As in Fig. 2, there are few outliers, e.g., Mz1, NGC 6369 and IC 1747. This result should take with caution, because the number of objects applied for the comparison is statistically unreliable. Figure 3 (right panel) shows photoionization distances versus trigonometric distances. The figure shows distance inconsistency for all objects except one. The result of the mean (1.08) and median (1.05) distance ratios $\langle {}^{D_{Pho}}/_{D_{Tri}} \rangle$ reveals that the photoionization method gives slightly higher distances compared to the trigonometric method. An example for inconsistent distance between both methods, NGC 40 has a trigonometric distance twice the photoionization distance. As in Fig. 3 (left panel), this result should take with caution due to the relatively small number of objects used in this comparison.

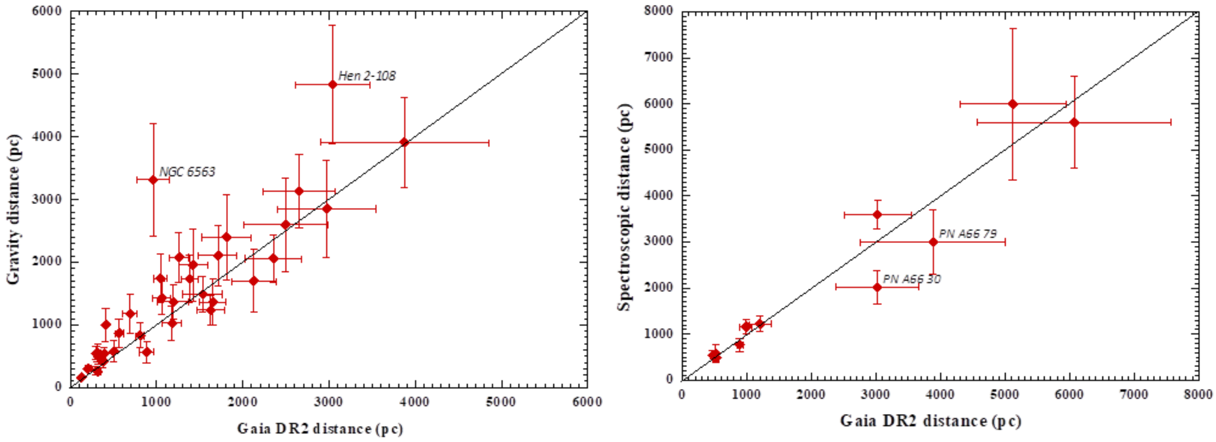

Figure 4: Comparison between the Gaia DR2 trigonometric distances and distances derived from the gravity method (left panel) and spectroscopic method (right panel). The diagonal solid line as defined in Figure 1.

A comparison between the gravity and trigonometric distances for 37 common objects is illustrated in Fig. 4 (left panel). The correlation coefficient is 0.87, which reflect a good correlation between both methods. Most of the objects have higher gravity distances comparing to trigonometric distances. This result is quite clear from the derived mean (1.3) and median (1.23) values$\langle {}^{D_{Gra}}/_{D_{Tri}} \rangle$. This comparison represents the best one in this study because it is based on a statistically large sample. The main result declares that the gravity method gives overestimate of the PN distances by at least 30% and 23% in case we adopt the mean and median ratios, respectively. Based on a sample of 15 objects, Ali and his colleagues (2015) [17] estimated mean and median ratios of 1.22 and 1.23, respectively, which analogy the present result. Further, but also based on a small statistical sample, Jacoby and Van de Steene (1995) [18] show the gravity method overestimate the PN distances by ∼ 40%. Furthermore, Harris and his colleagues (2007) [5] found that the gravity method overestimates the PNe distances by a factor of 30%. Reviewing Fig. 4 (left panel), it is apparent the gravity method gives a very high distance for few objects, e.g. Hen 2-108 (larger than 150%) and NGC 6563 (larger than 300%). Figure 4 (right panel) displays a comparison between the spectroscopic and trigonometric methods. Despite the small statistical sample used here, the spectroscopic method shows well agreement with trigonometric method. The mean and median distance ratios$\langle {}^{D_{Spe}}/_{D_{Tri}} \rangle$, and correlation coefficient are 1.0, 1.0, and 0.9, respectively. All objects, except PN A66 30, have consistent distances within the error range. The peculiar case of PN A66 30 can be interpreted due to the false binarity of the object or there is another companion for the PN primary central star. Table 3 summarizes the mean ratio (column 3), median ratio (column 4), and correlation coefficient (column 5) between the trigonometric and other individual distance methods. Further, it contains in column 2 the number of objects used in such comparisons.

Table 3: The ratio between Gaia DR2 trigonometric distance and other individual distance methods

Methods	# Objects	Mean	Median	Correlation coefficient
Extinction	23	1.08	0.95	0.84
Expansion	13	1.00	0.98	0.87
Kinematic	8	1.13	1.08	0.76
Photoionization Model	11	1.08	1.05	0.93
Gravity	37	1.30	1.23	0.87
Spectroscopic	11	1.00	1.01	0.96

It is essential to note that, the trigonometric method is useful for deducing the distances to nearby objects. Most parallax measurements are available for PNe with distance less than 4000 pc. The parallax measurements of distant PNe are limited and their uncertainties are worse than nearby objects. Fig. 4 (right panel) shows the trigonometric distances for the two distant nebulae Me 1-1(~ 5000 pc) and PN A66 14 (~6000pc).

6. Conclusion

The parallax measurements were known for a small number of PNe prior to the Gaia mission. Therefore, the comparison between the trigonometric and other individual methods was statistically unreliable (see [17]). The extracted PNe parallax measurements from Gaia DR2 provide us to do such comparisons with relatively reliable number of objects. The main results achieved in the present article are summarized as follows:

1. Starting by searching the literatures for confirmed planetary nebulae, known up to this time, followed by discussing the method used for selecting PNe central stars from Gaia DR, we were able to identify 2170 Gaia DR2 sources classified as PNe, from which we ignored all sources with negative parallax values, no parallax at all, and unmeasured colours. To achieve the best results for studies given in Sections 3 and 4, we restricted our analysis to the true CSs with parallax uncertainties less than 25%. Finally, a sample of 200 PNe with accurate parallax measurements was selected.
2. As a result of searching Gaia DR2 for true CSs, we found that the number of CSs in Gaia DR2 increases with increasing the size of searching circle, which reflect the large fraction of CSs that lie off nebular centres.
3. We noticed that most of the true red CSs in Gaia DR2 (BP - RP> 0.0) are associated with high flux excess factors, which frequently refer to inaccuracy in determining the blue and red photometric magnitudes.
4. Gaia DR2 trigonometric distances show a nearly perfect match to the previous ground-based trigonometric distances especially those obtained by Gutiérrez-Moreno and his colleagues (1999) [15] and Pottasch (1996) [1]. However, the ground-based trigonometric distances obtained by Harris and his colleagues (2007) [5] show somewhat smaller values with an average ratio of 0.97. In general, the

ground-based distances errors are much higher than those of Gaia DR2.

5. In reverse to the ground-based trigonometric distances, the HST distances was found to be a bit longer than that of Gaia DR2 with an average ratio of 1.1. The uncertainties in the HST [16] measurements are marginally higher than that of Gaia DR2.
6. To study the impact of using different individual methods of PNe distances determination, we discussed the consistency between the new trigonometric distance of Gaia DR2 with other individual distances methods in literature. Variation between these values can be observed. The results declare that the spectroscopic method is the best subsequent method for determining the PN distance after the trigonometric method. Applying other methods should take with care especially the gravity method which overestimate the Gaia DR2 trigonometric distance by an average of 30 %.

7. Recommendation

The upcoming catalogue of Gaia mission "Gaia DR3" will offer much more parallax measurements especially for more faint stars. Therefore, we expect to enhance the comparisons given here between the trigonometric and spectroscopic, expansion, extinction, photoionization, gravity and kinematic methods.

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APPENDIX

The final PNe sample. The name of the nebula, PNG number, Gaia number, right ascension, declination, galactic longitude, galactic latitude, spectral type of central star, reference of central star spectral type, parallax (millisecond), error in parallax (millisecond), distance (kpc), error in distance (kpc), G nebular magnitude, and blue-red central star colour are given in columns 2-16 respectively.

Table 4

No.	PN Name	PN G	Gaia DR2	RA deg	Dec deg	L deg	B deg	Spectral Classification	Ref.	P mas	σ_P mas	D (kpc)	σ_D (kpc)	G. mag.	Bp-rp
1	[D75b] Em* 21-021	093.9-00.1	2171652769005709568	322.494	51.067	93.987	-0.118	O7(f)-[WC11]	1	0.25	0.018	4.014	0.298	13.75	1.76
2	[FMP2006b] Fr 2-8	313.8+10.3	6090256513264898816	210.174	-51.041	313.899	10.354			0.50	0.068	1.981	0.265	16.09	-0.07
3	BMP J0739-1418	231.1+03.9	3030005560828868096	114.961	-14.307	231.189	3.905	Blue	1	0.47	0.054	2.114	0.240	15.62	-0.16
4	BMP J1759-3321	357.7-04.8	4042513447762858880	269.938	-33.354	357.724	-4.846	Blue	1	1.19	0.198	0.838	0.139	18.19	-0.01
5	EGB 6	221.6+46.4	615161091995252864	148.246	13.743	221.589	46.364	hgO(H)	1	0.73	0.167	1.363	0.310	15.97	-0.51
6	ESO 217-11	293.6+10.9	5369311141281715072	178.278	-50.849	293.614	10.964	H-rich	1	0.68	0.171	1.469	0.368	18.28	-0.29
7	ESO 40-11	305.6-13.1	5790663302917359872	203.560	-75.775	305.617	-13.127			0.41	0.060	2.453	0.359	15.72	-0.39
8	FP J0904-4023	263.1+04.3	5620675957697739648	136.010	-40.37	263.164	4.325	Blue	1	0.92	0.105	1.092	0.125	17.74	-0.18

					2										
9	FP J0905-3033	255.8+10.9	5635240088724202496	136.272	-30.553	255.861	10.967			1.34	0.073	0.745	0.041	16.46	-0.48
10	FP J0911-4051	264.5+05.0	5428634329076290944	137.940	-40.866	264.521	5.075	Blue	1	0.95	0.217	1.051	0.240	18.95	-0.27
11	FP J1824-0319	026.9+04.4	4269678120544342144	276.170	-3.333	26.900	4.415			4.89	0.073	0.205	0.003	14.83	-0.51
12	Hen 2-105	308.6-12.2	5796437220731788288	213.853	-74.213	308.657	-12.282	OB, early O	1, 2	0.28	0.049	3.613	0.645	14.61	-0.26
13	Hen 2-108	316.1+08.4	5897352631316651264	214.537	-52.178	316.170	8.451	wels, Of(H)	1, 3	0.36	0.039	2.787	0.299	12.68	0.23
14	Hen 2-119	317.1-05.7	5873264285765311232	227.670	-64.674	317.138	-5.714			0.65	0.135	1.532	0.316	17.83	0.35
15	Hen 2-178	344.2+04.7	5971001081288743808	250.640	-38.911	344.275	4.751			0.32	0.047	3.103	0.456	13.73	2.41
16	Hen 2-36	279.6-03.1	5306043043221261568	145.857	-57.282	279.608	-3.186	A2 III??	1, 2	0.22	0.028	4.569	0.588	11.19	0.93
17	Hen 2-438	064.7+05.	203274476923415001	293.68	30.51	64.785	5.019	[WC9]	1	0.59	0.06	1.70	0.18	10.2	0.47

		0	6	8	6						3	6	4	5	
18	Hen 3-172	249.0+06.9	5646499053433949440	127.929	-27.759	249.078	6.969			0.37	0.027	2.693	0.195	11.68	0.88
19	IC 1295	025.4-04.7	4203649492421426816	283.655	-8.827	25.418	-4.714	hgO(H)	1	0.69	0.084	1.454	0.178	16.85	-0.23
20	IC 1747	130.2+01.3	511904404556131200	29.399	63.322	130.277	1.397	[WO4]	1	0.31	0.051	3.245	0.533	15.70	0.28
21	IC 2448	285.7-14.9	5222772389050179840	136.776	-69.942	285.799	-14.952	O(H), O(H)3 III-V	1, 4	0.29	0.045	3.469	0.546	14.01	-0.62
22	IC 289	138.8+02.8	463228376251556224	47.580	61.317	138.817	2.805	O(H)	1	0.63	0.060	1.592	0.153	16.40	0.60
23	IC 3568	123.6+34.5	1720138697015345024	188.279	82.564	123.651	34.539	O3(H)	1	0.37	0.056	2.728	0.420	12.78	-0.35
24	IC 418	215.2-24.2	2985789113026163584	81.868	-12.697	215.212	-24.284	Of(H)	1	0.65	0.054	1.550	0.130	10.05	0.07
25	IC 4593	025.3+40.8	4457218245479455744	242.936	12.071	25.334	40.836	O7	1	0.38	0.079	2.629	0.549	11.17	-0.33
26	IC 4637	345.4+00.1	5966769881320062208	256.294	-40.886	345.479	0.140	O(H)	1	0.75	0.043	1.326	0.075	12.51	0.61
27	IC 5148	002.7-52.4	6574225217863069056	329.896	-39.38	2.711	-52.44	hgO, (H)O?	1, 2	0.78	0.087	1.279	0.142	16.10	-0.64

					6		0								
28	IC 972	326.7+42.2	6291509197468092672	211.108	-17.228	326.761	42.241			0.50	0.103	1.989	0.409	17.27	0.89
29	Jacoby 1	085.4+52.3	1595941441250636672	230.444	52.368	85.366	52.349	PG 1159	1	1.33	0.062	0.749	0.035	15.56	-0.66
30	LTNF 1	144.8+65.8	786919754746647424	179.437	48.938	144.811	65.846	M3 V	1	0.60	0.033	1.659	0.092	15.19	0.42
31	MPA J1508-6455	316.7-05.8	5872884511895152768	227.027	-64.930	316.771	-5.797	Blue	1	0.14	0.029	6.952	1.395	13.47	0.72
32	MPA J1759-3007	000.5-03.1a	4056239308511987328	269.856	-30.121	0.507	-3.188			3.46	0.511	0.289	0.043	19.08	1.70
33	MPA J1858-1430	020.7-08.0	4101453112078146432	284.580	-14.507	20.706	-8.054	Blue	1	0.77	0.125	1.293	0.208	16.39	0.08
34	MWP 1	080.3-10.4	1855295171732158080	319.284	34.208	80.356	-10.409	PG 1159	1	1.99	0.050	0.502	0.013	13.05	-0.59
35	NAME PN Alv 1	079.8-10.2	1866922365452368768	318.778	33.972	79.889	-10.264			0.73	0.162	1.373	0.306	18.32	-0.44
36	NAME PN AMU 1	075.9+11.6	2125895669204184832	292.787	43.416	75.999	11.650	O(H)3 Vz	4	0.65	0.039	1.545	0.093	13.59	-0.46

37	NAME PN Pa 9	189.1-07.7	3397406031212946944	84.492	17.109	189.180	-7.694			0.92	0.219	1.089	0.260	18.12	1.99
38	NAME PN SkAc 1	003.3+66.1	1227151802340968832	214.091	13.873	3.392	66.165			1.37	0.337	0.732	0.180	18.51	-0.36
39	NeVe 3-2	326.4+07.0	5902564934924665984	229.933	-48.999	326.415	6.993	O(H)4 Vz	4	0.26	0.043	3.869	0.642	15.28	0.18
40	NGC 1360	220.3-53.9	5084896688945791232	53.311	-25.872	220.363	-53.934	O(H)	1	2.55	0.082	0.392	0.013	11.26	-0.64
41	NGC 1501	144.1+06.1	473712872456844544	61.747	60.921	144.560	6.551	[WO4]	1	0.57	0.025	1.763	0.079	14.24	0.57
42	NGC 1514	165.5-15.2	168937010969340160	62.321	30.776	165.534	-15.288	sdO + A0 III	1	2.14	0.039	0.466	0.008	9.27	0.82
43	NGC 1535	206.4-40.5	3189152962633165056	63.566	-12.739	206.477	-40.565	O5	1	0.82	0.063	1.215	0.093	12.07	-0.48
44	NGC 2022	196.6-10.9	3336140414380977664	85.526	9.086	196.685	-10.942	O(H)	1	0.53	0.079	1.882	0.280	15.66	-0.27
45	NGC 2346	215.6+03.6	3109444657456300288	107.344	-0.807	215.699	3.621	A5 V	1	0.69	0.043	1.457	0.092	11.19	0.38
46	NGC 2371	189.1+19.8	885587110718845568	111.395	29.491	189.156	19.843	[WO1]	1	0.53	0.066	1.879	0.232	14.79	-0.52

47	NGC 2392	197.8+17.3	865037169677723904	112.295	20.912	197.878	17.400	O6f	1	0.50	0.049	1.998	0.197	10.67	-0.30
48	NGC 2438	231.8+04.1	3029214290412318720	115.460	-14.735	231.801	4.117	M3 V	1	2.37	0.223	0.422	0.040	17.06	-0.17
49	NGC 246	118.8-74.7	2376592910265354368	11.764	-11.872	118.863	-74.709	PG 1159 (lg E)	1	1.95	0.101	0.512	0.026	11.81	-0.65
50	NGC 2610	239.6+13.9	5709928951521751168	128.348	-16.149	239.629	13.948	WD?	1	0.42	0.075	2.384	0.428	15.90	-0.55
51	NGC 3132	272.1+12.3	5420219732228461184	151.757	-40.436	272.114	12.397	A2 V	1	1.16	0.050	0.865	0.038	10.03	0.16
52	NGC 3242	261.0+32.0	5668874905325843456	156.192	-18.642	261.051	32.050	O(H)	1	0.68	0.088	1.466	0.190	12.20	-0.56
53	NGC 3587	148.4+57.0	843950873117830528	168.699	55.019	148.490	57.050	hgO(H)	1	1.14	0.066	0.879	0.051	15.73	-0.63
54	NGC 3699	292.6+01.2	5336133687170599040	171.991	-59.958	292.656	1.238			0.65	0.097	1.543	0.232	17.60	-0.17
55	NGC 40	120.0+09.8	537481007814722688	3.254	72.522	120.016	9.868	[WC8]	1	0.50	0.029	1.984	0.114	11.45	0.33
56	NGC 4361	294.1+43.	351961406857806156	186.12	-	294.11	43.62	O6	1	0.97	0.07	1.02	0.08	13.1	-

		6	8	8	18.785	4	5				5	7	0	0	0.60
57	NGC 5189	307.2-03.4	5863702868275424384	203.387	-65.974	307.206	-3.452	[WO1]	1	0.59	0.031	1.682	0.089	14.44	-0.02
58	NGC 5882	327.8+10.0	6000019147299399936	229.208	-45.650	327.818	10.080	Of(H)	1	0.51	0.067	1.972	0.259	13.08	-0.17
59	NGC 6026	341.6+13.7	6011169161583903488	240.338	-34.543	341.605	13.704	OB, O7	1,2	0.31	0.039	3.227	0.407	13.14	0.04
60	NGC 6058	064.6+48.2	1380199049219990784	241.111	40.683	64.668	48.300	O9	1	0.32	0.038	3.125	0.375	13.74	-0.60
61	NGC 6153	341.8+05.4	6017034570775817984	247.877	-40.254	341.845	5.438	wels	1	0.73	0.065	1.362	0.120	15.18	0.64
62	NGC 6337	349.3-01.1	5972577055062637056	260.565	-38.484	349.351	-1.115	emission-line, wels, not classif	1, 2, 3	0.54	0.061	1.844	0.207	15.64	0.33
63	NGC 6369	002.4+05.8	4111368477921050368	262.335	-23.760	2.432	5.847	[WO3]	1	0.88	0.062	1.139	0.081	15.62	1.60
64	NGC 6543	096.4+29.9	1633325248915154176	269.639	66.633	96.468	29.954	wels, Of-WR(H)	1, 3	0.62	0.071	1.626	0.187	11.19	-0.39
65	NGC 6563	358.5-07.3	403960053654439539	273.01	-	358.50	-7.337			1.07	0.18	0.93	0.16	17.1	-

			2	1	33.869	4					9	2	4	7	0.40
66	NGC 6578	010.8-01.8	4094354493205707392	274.069	-20.451	10.818	-1.827	wels	1	0.54	0.069	1.849	0.235	15.23	0.69
67	NGC 6629	009.4-05.5	4089517157442187008	276.427	-23.203	9.407	-5.049	[WC4]?	1	0.45	0.051	2.198	0.244	12.68	0.45
68	NGC 6720	063.1+13.9	2090486618786534784	283.396	33.029	63.170	13.978	DA(O?)	1	1.27	0.059	0.787	0.037	15.61	-0.57
69	NGC 6772	033.1-06.3	4261038467432411776	288.651	-2.707	33.159	-6.387			0.92	0.206	1.085	0.243	18.41	0.42
70	NGC 6781	041.8-02.9	4294123077230164736	289.617	6.539	41.841	-2.987			2.04	0.089	0.489	0.021	16.75	0.35
71	NGC 6804	045.7-04.5	4296362443149857920	292.896	9.225	45.749	-4.589	O9	1	1.14	0.065	0.878	0.050	14.00	0.49
72	NGC 6826	083.5+12.7	2135352396915239808	296.201	50.525	83.562	12.792	O3f(H)	1	0.63	0.048	1.575	0.118	10.58	-0.34
73	NGC 6842	065.9+00.5	2028777318992611072	298.760	29.288	65.914	0.598			0.48	0.046	2.099	0.202	16.10	0.36
74	NGC 6853	060.8-03.6	1827256624493300096	299.902	22.721	60.836	-3.696	DAO	1	2.66	0.044	0.376	0.006	14.03	-0.59
75	NGC 6879	057.2-08.9	1809552460055588608	302.611	16.923	57.228	-8.918	wels, O3f(He)	1, 3	0.75	0.103	1.341	0.185	14.21	-0.11
76	NGC 6891	054.1-12.1	180323490676269273	303.78	12.70	54.197	-	wels, O3 Ib	1, 3	0.41	0.05	2.45	0.30	12.2	-

			6	7	4		12.112	(f*)			1	5	9	6	0.26
77	NGC 6894	069.4-02.6	2053683628140774528	304.100	30.565	69.476	-2.622	WD?	1	0.84	0.131	1.192	0.186	18.17	0.41
78	NGC 6905	061.4-09.5	1816547660416810880	305.596	20.104	61.491	-9.571	[WO2]	1	0.40	0.046	2.503	0.286	14.55	-0.28
79	NGC 7009	037.7-34.5	6889338034837425920	316.045	-11.363	37.762	-34.571	O(H)	1	0.87	0.116	1.154	0.155	12.60	-0.54
80	NGC 7048	088.7-01.6	2164192930525717248	318.563	46.288	88.780	-1.681			1.02	0.253	0.978	0.242	18.90	0.09
81	NGC 7094	066.7-28.2	1770058865674512896	324.221	12.789	66.778	-28.202	hybrid	1	0.61	0.059	1.626	0.155	13.53	-0.45
82	NGC 7293	036.1-57.1	6628874205642084224	337.411	-20.837	36.161	-57.118	DAO	1	4.98	0.076	0.201	0.003	13.48	-0.63
83	NGC 7354	107.8+02.3	2201080755349789568	340.083	61.286	107.844	2.315	cont.	1	0.45	0.085	2.201	0.414	17.13	0.97
84	NGC 7662	106.5-17.6	1924818288379268736	351.474	42.535	106.559	-17.601	UV emission lines	1	0.51	0.075	1.979	0.292	13.65	-0.52
85	Patchick 5	076.3+14.1	2127040806264002944	289.877	44.762	76.325	14.116	O(He)	5	0.41	0.053	2.443	0.314	15.69	-0.41
86	PFP 1	222.1+03.	305809420026463731	110.57	-6.363	222.12	3.910	pre-WD?	1	1.65	0.08	0.60	0.03	15.8	-

		9	2	4		9					3	5	1	4	0.65
87	PHL 932	125.9-47.0	2778355352407184128	14.986	15.737	125.939	-47.085	hgO(H)	1	3.22	0.076	0.311	0.007	12.06	-0.47
88	PHR J0723+0036	216.0+07.4	3110803653827201280	110.952	0.609	216.096	7.477	[WR]	1	0.25	0.035	4.005	0.568	13.85	-0.04
89	PHR J0740-2055	237.0+00.7	5715387335262528640	115.095	-20.932	237.027	0.761			0.72	0.142	1.379	0.271	18.13	-0.34
90	PHR J1134-5243	291.3+08.4	5345597458614614400	173.661	-52.726	291.318	8.406	[WO4]-[WC4]	1	0.21	0.036	4.699	0.801	13.00	0.17
91	PHR J1418-5144	316.3+08.8	5897438771177986432	214.607	-51.744	316.357	8.846			0.77	0.106	1.298	0.179	17.27	-0.22
92	PHR J1804-2645	004.0-02.6	4063311229893337600	271.248	-26.754	4.044	-2.597			1.15	0.118	0.868	0.089	16.51	1.53
93	PN A66 14	197.8-03.3	3330404266518636416	92.786	11.779	197.849	-3.400	B5 III-V, B8-9	1, 2	0.19	0.036	5.135	0.949	15.09	0.77
94	PN A66 20	214.9+07.8	3135710272253699584	110.740	1.759	214.967	7.815	O(H)	1	0.61	0.081	1.650	0.220	16.45	-0.44
95	PN A66 21	205.1+14.2	3163546505053645056	112.261	13.247	205.139	14.241	PG 1159 (E)	1	1.86	0.081	0.538	0.023	15.96	-0.59
96	PN A66 24	217.1+14.	308899102675746880	117.90	3.006	217.17	14.75			1.43	0.12	0.70	0.06	17.4	-

		7	0	6		5	2				9	1	3	1	0.61
97	PN A66 28	158.8+37.1	1040417211407001984	130.398	58.230	158.802	37.179			2.58	0.094	0.388	0.014	16.52	-0.47
98	PN A66 29	244.5+12.5	5703415268543295744	130.079	-20.910	244.603	12.564			0.85	0.172	1.178	0.238	18.27	-0.58
99	PN A66 3	131.5+02.6	515007024509005440	33.028	64.151	131.587	2.643			0.34	0.084	2.920	0.716	17.19	1.50
100	PN A66 30	208.5+33.2	660071056749861888	131.723	17.880	208.557	33.289	[WC]-PG1159	1	0.36	0.051	2.768	0.389	14.36	-0.24
101	PN A66 31	219.1+31.2	597324024095840512	133.555	8.898	219.133	31.291	hgO(H)	1	1.96	0.088	0.511	0.023	15.48	-0.55
102	PN A66 33	238.0+34.8	3827045525522912128	144.788	-2.808	238.022	34.864	O(H), DAO	1, 4	1.04	0.081	0.959	0.075	15.96	-0.37
103	PN A66 34	248.7+29.5	5690534730341025408	146.397	-13.171	248.708	29.540	hgO(H)	1	0.86	0.100	1.161	0.135	16.42	-0.60
104	PN A66 35	303.6+40.0	3499149202247569536	193.386	-22.873	303.566	39.996	? + G8 IV	1	7.99	0.138	0.125	0.002	9.35	1.16
105	PN A66 36	318.4+41.4	6292074655679874688	205.172	-19.882	318.463	41.500	O(H)	1	2.29	0.083	0.437	0.016	11.51	-0.50
106	PN A66 39	047.0+42.4	1305573511415857536	246.890	27.909	47.052	42.483	hgO(H)	1	0.99	0.055	1.011	0.056	15.59	-0.53

107	PN A66 43	036.0+17.6	4488953930631143168	268.384	10.623	36.062	17.620	hybrid	1	0.43	0.061	2.319	0.327	14.68	-0.28
108	PN A66 46	055.4+16.0	4585381817643702528	277.827	26.937	55.413	16.032	M6 V	1	0.33	0.044	3.043	0.408	14.94	-0.30
109	PN A66 51	017.6-10.2	4086643583803222400	285.256	-18.204	17.616	-10.242	O(H), O(H)3-5 Vz	1, 4	0.44	0.045	2.278	0.235	15.36	-0.17
110	PN A66 57	058.6+06.1	2024098484670541952	289.274	25.626	58.613	6.175			0.51	0.093	1.967	0.360	17.56	0.40
111	PN A66 6	136.1+04.9	467936205865972352	44.674	64.502	136.099	4.934			1.00	0.177	0.996	0.176	18.42	0.99
112	PN A66 61	077.6+14.7	2127684982639844224	289.793	46.248	77.699	14.778	hgO(H)	1	0.58	0.086	1.712	0.253	17.29	-0.56
113	PN A66 63	053.8-03.0	1820963913284517504	295.543	17.087	53.891	-3.027	M4 V	1	0.36	0.034	2.770	0.263	15.10	0.16
114	PN A66 65	017.3-21.9	6864617817991978624	296.643	-23.137	17.305	-21.972	Op k	1	0.63	0.051	1.593	0.129	15.46	0.17
115	PN A66 66	019.8-23.7	6864496115795567488	299.381	-21.613	19.842	-23.782			1.05	0.220	0.955	0.201	18.12	-0.27
116	PN A66 7	215.5-30.8	2986220396462236032	75.781	-15.606	215.570	-30.855	DAO	1	2.02	0.072	0.495	0.018	15.45	-0.53
11	PN A66 72	059.7-18.7	176134141779912832	312.50	13.55	59.795	-			0.69	0.08	1.44	0.18	16.0	-

7			0	9	8		18.729				8	4	4	4	0.54
118	PN A66 74	072.7-17.1	1840395547924993152	319.218	24.148	72.663	-17.152	DAO	1	1.47	0.156	0.678	0.072	17.05	-0.52
119	PN A66 78	081.2-14.9	1850685091269441792	323.872	31.696	81.296	-14.913	[WC]-PG1159	1	0.63	0.064	1.581	0.161	13.15	-0.36
120	PN A66 79	102.9-02.3	2004936573978252672	336.572	54.827	102.982	-2.322	F0 V	1	0.29	0.056	3.483	0.682	16.65	1.24
121	PN A66 82	114.0-04.6	1998212476247082880	356.449	57.066	114.067	-4.671	K0 IV	1	0.50	0.022	2.014	0.088	14.43	1.55
122	PN ARO 121	164.8+31.1	936605992140011392	119.465	53.421	164.806	31.181	PG 1159 (E:)	1	0.99	0.102	1.012	0.105	17.09	-0.63
123	PN DeHt 2	027.6+16.9	4376331092036268032	265.420	3.116	27.650	16.925	O	1	0.58	0.070	1.717	0.205	15.00	-0.33
124	PN DeHt 5	111.0+11.6	2229624931896924160	334.890	70.934	111.091	11.641	DA	1	3.11	0.050	0.321	0.005	15.47	-0.36
125	PN DS 1	283.9+09.7	5362804330246457344	163.669	-48.784	283.903	9.726	M5 V	1	1.29	0.041	0.773	0.024	12.18	-0.32
126	PN DS 2	335.5+12.4	6008325614048284416	235.771	-39.304	335.584	12.448	O(H)	1	1.21	0.062	0.828	0.042	12.35	-0.29
12	PN Fg 1	290.5+07.	534819594818515673	172.15	-	290.50	7.927			0.47	0.06	2.10	0.27	14.5	-

7		9	6	1	52.934	5					1	6	2	0	0.31
128	PN G284.2-05.3	284.2-05.3	5255947536784791936	150.328	-61.868	284.262	-5.329	[WR]	1	0.27	0.067	3.706	0.922	16.78	-0.28
129	PN H 3-75	193.6-09.5	3340384082588168960	85.187	12.356	193.647	-9.575	G-K	1	0.23	0.039	4.333	0.724	13.82	1.40
130	PN HaTr 4	335.2-03.6	5937103069115240192	251.251	-51.206	335.252	-3.620			0.36	0.079	2.752	0.596	16.69	0.71
131	PN HaTr 7	332.5-16.9	5911656865276078080	268.539	-60.833	332.507	-16.911	DAO	1	0.51	0.055	1.960	0.213	14.86	-0.40
132	PN HaWe 5	156.9-13.3	223404549266115456	56.361	37.814	156.909	-13.322	DA	1	3.17	0.119	0.316	0.012	17.42	-0.23
133	PN HbDs 1	273.6+06.1	5411328565822822528	148.185	-46.280	273.672	6.192	O(H), O(H)3 Vz	1, 4	1.43	0.048	0.700	0.023	12.46	-0.36
134	PN HDW 1	124.0+10.7	535357713421191168	16.782	73.556	124.061	10.719	DA	1	3.19	0.057	0.313	0.006	16.42	-0.19
135	PN HDW 11	034.1-10.5	4213334746695221888	292.780	-3.709	34.146	-10.516	hgO(H)	1	0.43	0.106	2.332	0.579	16.71	0.11
13	PN HDW 12	014.8-25.6	675424024656439078	299.55	-	14.880	-			1.79	0.34	0.55	0.10	18.5	-

6			4	4	26.471		25.602				2	8	7	4	0.41
137	PN HDW 13	099.7-08.8	1986574557983855104	337.639	47.523	99.717	-8.897			0.91	0.157	1.101	0.190	18.29	-0.44
138	PN HDW 3	149.4-09.2	241918950690107264	51.814	45.406	149.500	-9.277	DAO	1	1.16	0.093	0.862	0.069	17.16	-0.19
139	PN HDW 4	156.3+12.5	268129413812162816	84.484	55.538	156.309	12.545	DA	1	3.35	0.096	0.298	0.009	16.51	-0.42
140	PN HDW 5	218.9-10.7	3001563840710096512	95.905	-10.223	218.987	-10.777	hgO(H)	1	0.90	0.083	1.106	0.101	16.13	0.24
141	PN HFG 1	136.3+05.5	468033345145186816	45.946	64.910	136.381	5.553	F9 V	1	1.40	0.022	0.716	0.011	14.04	0.65
142	PN HFG 2	247.5-04.7	5594969135329315072	115.599	-32.797	247.577	-4.704			0.57	0.070	1.764	0.219	17.04	-0.14
143	PN IsWe 1	149.7-03.3	250358801943821952	57.275	50.004	149.715	-3.398	PG 1159 (A)	1	2.25	0.083	0.445	0.016	16.50	-0.26
144	PN IsWe 2	107.7+07.8	2218688261534278912	333.344	65.899	107.728	7.809	DA	1	1.12	0.121	0.890	0.096	18.13	-0.08
145	PN Jn 1	104.2-29.6	2871119705335735552	353.972	30.468	104.208	-29.642	PG 1159 (E)	1	1.21	0.090	0.826	0.061	16.02	-0.53
146	PN K 1-16	094.0+27.4	2160562927224840576	275.467	64.365	94.025	27.428	PG 1159 (lg E)	1	0.47	0.053	2.146	0.243	14.99	-0.63

147	PN K 1-2	253.5+10.7	5647809392112960000	134.441	-28.960	253.577	10.780	K2 V (earlier than)	1	0.47	0.115	2.115	0.514	17.06	0.16
148	PN K 1-27	286.8-29.5	4648434175230114048	89.259	-75.673	286.877	-29.577	O(He)	1	0.18	0.046	5.496	1.385	16.05	-0.54
149	PN K 2-2	204.1+04.7	3158419684195782656	103.097	9.965	204.150	4.734	hgO(H), early O	1, 2	1.16	0.059	0.863	0.044	14.22	-0.53
150	PN K 2-7	019.4-19.6	6868431267915481088	295.121	-20.452	19.407	-19.659			0.57	0.036	1.750	0.112	12.39	1.53
151	PN K 3-81	083.9-08.4	1964102533180564096	320.564	38.121	83.938	-8.437			0.19	0.046	5.161	1.232	15.72	-0.28
152	PN Lo 1	255.3-59.6	4755520010701141504	44.244	-44.172	255.321	-59.620	hgO(H)	1	1.24	0.043	0.808	0.028	15.16	-0.65
153	PN Lo 16	349.3-04.2	5960852520245103744	263.925	-40.191	349.362	-4.224	O(H)3-4 Vz ((fc))	4	0.55	0.061	1.829	0.205	16.06	0.80
154	PN Lo 5	286.5+11.6	5374348102823679744	168.476	-47.950	286.524	11.790			0.63	0.101	1.590	0.255	16.93	-0.52
155	PN Lo 8	310.3+24.7	6162542191540458112	201.406	-37.604	310.383	24.773	O(H), O(H)3 Vz	1, 4	0.95	0.120	1.048	0.132	12.93	-0.54

156	PN LoTr 11	313.8-12.6	5795257990207545984	230.294	-72.224	313.894	-12.619			0.72	0.151	1.393	0.293	18.30	-0.42
157	PN LoTr 5	339.9+88.4	3958428334589607552	193.890	25.892	339.896	88.457	G5 III	1	1.98	0.046	0.506	0.012	8.63	1.04
158	PN M 1-27	356.5-02.3	4053955824662571648	266.689	-33.143	356.531	-2.394	[WC11]? peculiar	1, 2	0.33	0.037	3.023	0.340	13.91	1.39
159	PN M 1-32	011.9+04.2	4144897913181069184	269.084	-16.485	11.977	4.234			0.39	0.076	2.542	0.494	15.39	1.19
160	PN M 1-46	016.4-01.9	4103910524954236928	276.985	-15.548	16.451	-1.975	wels, Of(H), O(H)7 I(fc)	1, 3, 4	0.32	0.042	3.083	0.398	12.84	0.74
161	PN M 1-65	043.1+03.8	4311868924367555200	284.140	10.869	43.198	3.810	O6	1	0.22	0.040	4.467	0.797	14.36	0.99
162	PN M 1-73	051.9-03.8	4318420669299100288	295.289	14.950	51.907	-3.867	wels, O3.5 I f	1, 3	0.24	0.061	4.149	1.048	14.22	0.63
163	PN M 1-77	089.3-02.2	1971995510535755648	319.781	46.313	89.384	-2.266	OB?	1	0.39	0.027	2.589	0.184	11.93	0.96
164	PN M 3-4	241.0+02.3	5710725616423348352	118.797	-23.637	241.092	2.353	cont.	1	0.22	0.032	4.508	0.657	15.22	1.46
165	PN M 3-6	253.9+05.7	5639472001599302528	130.168	-32.37	253.971	5.778	wels, wels	1, 2	0.31	0.045	3.182	0.459	13.07	-0.07

					6										
166	PN MaC 1-2	309.5-02.9	5852194829848899840	208.613	-64.994	309.531	-2.932			0.75	0.032	1.341	0.058	15.13	1.08
167	PN Me 1-1	052.5-02.9	4318785810234714752	294.791	15.947	52.542	-2.960	K (1-2) II	1	0.23	0.037	4.434	0.723	12.32	1.19
168	PN MeWe 2-4	314.0+10.6	6090271154808162048	210.314	-50.669	314.086	10.683			0.85	0.148	1.171	0.204	17.91	-0.20
169	PN Mz 1	322.4-02.6	5881838006914886784	233.569	-59.152	322.491	-2.611			0.70	0.139	1.423	0.281	17.98	0.24
170	PN PB 4	275.0-04.1	5310278598198854016	138.782	-54.879	275.084	-4.162	emission-line, wels?	1, 2	0.30	0.069	3.286	0.747	16.10	-0.01
171	PN Pe 1-15	025.9-02.1	4252321092669538176	281.601	-7.243	25.911	-2.184			0.20	0.034	5.011	0.844	14.70	1.83
172	PN Pe 1-19	026.5-03.0	4252307211263954688	282.436	-7.026	26.481	-2.823			0.37	0.068	2.733	0.505	15.71	0.16
173	PN PuWe 1	158.9+17.8	997854527884948992	94.891	55.612	158.922	17.855	DAO	1	2.43	0.082	0.412	0.014	15.52	-0.46
174	PN Sa 1-8	020.7-05.9	4102207686291028864	282.685	-13.517	20.779	-5.966	OB, O, O(H)4-8 III	1,2,4	0.35	0.045	2.859	0.366	14.22	0.26
17	PN Sp 1	329.0+01.	598207213254582412	237.92	-	329.07	1.957	O(H), O(H)3-	1,4	0.67	0.02	1.49	0.05	13.7	0.70

5		9	8	1	51.52 5	9		5 (fc)			3	6	2	3	
17 6	PN SuWt 2	311.0+02. 4	587059298789309798 4	208.93 0	- 59.37 8	311.04 6	2.478	B9 V	1	0.38	0.03 6	2.64 7	0.25 5	11.9 0	0.66
17 7	PN Th 2-A	306.4-00.6	586519236296308659 2	200.64 1	- 63.35 0	306.41 4	-0.689			0.17	0.04 0	5.93 0	1.41 4	15.9 6	1.73
17 8	PN V-V 3-5	014.0-05.5	409247240417708787 2	279.13 4	- 19.32 5	14.028	-5.528	A	1	0.63	0.03 0	1.58 1	0.07 4	13.2 7	0.79
17 9	PN We 1-10	086.1+05. 4	217983258576193203 2	307.96 8	48.88 0	86.191	5.460			0.63	0.11 9	1.58 5	0.30 0	18.0 1	- 0.25
18 0	PN We 1-6	224.9+01. 0	304720425914952448 0	109.35 9	- 10.17 7	224.94 2	1.065	hgO(H)	1	0.59	0.05 6	1.70 6	0.16 3	15.8 0	- 0.08
18 1	PN WeDe 1	197.4-06.4	334199655504804185 6	89.854	10.69 5	197.40 5	-6.442	DA	1	1.80	0.12 7	0.55 6	0.03 9	17.2 0	- 0.48
18 2	PNS-EPN NGC1023-194	145.0-19.0	334229755066622720	40.174	39.02 4	145.09 6	- 19.10 0			0.45	0.07 7	2.23 2	0.38 5	15.8 4	0.73
18 3	PPA J1835-2811	005.8-09.2	404863147827633984 0	278.83 8	- 28.19 8	5.892	-9.233			1.77	0.32 0	0.56 6	0.10 2	18.6 1	- 0.05
18	RCW 24	258.5-01.3	552793458714141516	126.44	-	258.50	-1.289	absorption	1, 4	1.20	0.13	0.83	0.09	18.2	0.09

4			8	8	40.219	9		lines, DA			9	5	7	0	
185	SH 2-174	120.3+18.3	2286296686066976896	356.259	80.950	120.217	18.430	DAO	1	3.41	0.035	0.293	0.003	14.54	-0.53
186	Sh 2-176	120.2-05.3	421836329014389248	7.972	57.380	120.288	-5.396	DA	1	1.17	0.195	0.853	0.142	18.51	-0.11
187	SH 2-188	128.0-04.1	509206447837376128	22.638	58.414	128.049	-4.069	DAO	1	1.13	0.100	0.887	0.079	17.40	-0.03
188	SH 2-216	158.5+00.7	254092090595748096	70.839	46.702	158.486	0.472	DAO	1	7.94	0.066	0.126	0.001	12.63	-0.56
189	SH 2-68	030.6+06.2	4276328581046447104	276.243	0.860	30.673	6.279	hybrid	1	2.48	0.075	0.404	0.012	16.43	0.28
190	SH 2-71	035.9-01.1	4268419106711771776	285.501	2.153	36.053	-1.367	A7 V - F0 V	1	0.59	0.035	1.700	0.100	13.47	1.21
191	SH 2-78	046.8+03.8	4506484097383382272	285.792	14.116	46.832	3.845	PG 1159	1	1.58	0.127	0.634	0.051	17.64	-0.05
192	TK 1	191.4+33.1	708990321934310784	126.773	31.502	191.405	33.084	DAO	1	1.87	0.079	0.535	0.023	15.68	-0.63
193	TK 2	096.8+31.9	1634314740658456320	264.511	66.896	96.892	31.962	DA	1	5.77	0.046	0.173	0.001	14.56	-0.61
194	WRAY 72	341.5+12.1	6010805807350513920	241.619	-35.753	341.549	12.105	[WC3]	1	0.71	0.039	1.418	0.079	13.91	0.21
195	WRAY 16-139	309.0-04.2	5851865148069389568	208.128	-66.39	309.003	-4.241	[WC9]	1	0.17	0.020	5.889	0.701	13.18	0.37

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196	WRAY 16-151	312.6-01.8	5854138766383247232	214.681	-63.119	312.612	-1.900	emission-line, [WC10-11], O(H)4 Ifc	1, 2, 4	0.21	0.027	4.688	0.587	14.62	1.21
197	WRAY 16-74	288.8-05.2	5251802141752703360	158.940	-64.320	288.879	-5.216			0.34	0.025	2.916	0.213	15.06	1.66
198	WRAY 17-1	258.0-15.7	5509004952576699904	108.706	-46.961	258.068	-15.748	PG 1159	1	0.52	0.109	1.931	0.405	16.75	-0.04
199	WRAY 17-31	277.7-03.5	5307054800062198400	142.835	-56.294	277.714	-3.556	DAO	1	0.66	0.110	1.519	0.255	17.94	-0.35
200	Wray 17-40	286.2-06.9	5246408689299887488	151.748	-64.364	286.278	-6.949			0.25	0.061	4.052	1.009	16.51	-0.35