Uranometria 2000.0 Deep Sky Field Guide
Planetary Nebulae

The DSFG encompasses 1,144 planetary nebulae. These are shells of gas thrown off by stars having approximately the Sun's mass, that are nearing toward the end of their evolutionary cycle following the red-giant stage. The shell gradually expands, until after perhaps 100,000 years it becomes undetectably thin and all that remains is the central star. Some of the earliest such objects discovered (e.g., NGC 3242 on Chart 151, and NGC 6210 on Chart 68) were found by William Herschel, who noted the resemblance of their well-defined disks to those of planets, and gave them the name "planetary nebulae", but of course they have nothing to do with planets.

The brightest planetaries have a substantial disk, typically 30 arcseconds across, but the majority listed here are stellar (or nearly so) and can be identified at the eyepiece only with a nebula filter or direct-vision prism. Chart 164 lists over 100 such objects, hardly any of which are larger than a few arcseconds in diameter. A few of the oldest and nearest objects are so distended as to be practically invisible against the background sky. Between these two extremes, planetaries come in about as many shapes as there are objects, including the aptly-named Ring Nebula on Chart 49 and the complex southern object NGC 5189 on Chart 208.

In visible light, planetary nebulae shine predominantly at the two wavelengths emitted by doubly-ionized oxygen, denoted by the symbol [OIII]. Typically, 90% of the visually-detectable light comes from the [OIII] lines at 5007Å and 4959Å in the blue-green part of the spectrum. As a result, when an [OIII] filter is placed between the eye and the eyepiece, stars are dimmed by as much as three magnitudes (the night-sky light even more), while light from a planetary passes through virtually unchanged. By rapidly passing an [OIII] filter between the eye and eyepiece and out again while examining the field, a planetary will usually appear to "blink" as the stars are dimmed, and the nebula retains it brightness. There are a few planetaries that have weak [OIII] emission (a bright example is PN G64.7+5.0, Campbell's Hydrogen Star, on Chart 48), and these are best viewed either directly or with an Hβ filter, which passes the line that is brightest in these cases.

The planetary nebula data is based on a catalog prepared by Hynes (presented in his book *Planetary Nebulae*) and the *Strasbourg-ESO Catalogue of Galactic Planetary Nebulae* and contains the following information:

- Positions. These are taken from Gordon and Kapplan.
- Name. The original "PK" system is based on Galactic coordinates to whole degrees only and within each one-degree block planetary nebulae were assigned a serial number. Thus NGC 40 = PK 120+09 1 (no decimal) is in the Galactic longitude 120° block at +9° latitude, and is the first planetary cataloged in that block. Acker et al. decided that the general improvement in positions meant that it is was possible to assign a unique name based on Galactic coordinates if the positions were given to 0.1 degree precision. Thus PN G120.0+09.8 shows that the object is at 120.0° longitude and +9.8° latitude. Since the boxes are now only 6′ on a side they are small enough that every object can have a unique name and it is not anticipated that another naming scheme will be needed in the future. These names have been adopted by modern catalogers.
- Magnitudes. These are given in two columns: photographic-blue and visual. The visual magnitudes were computed and provided by Marling, who summed the brightness of the emission lines for each object and adjusted the resulting value to account for the sensitivity of the dark-adapted eye. The uncertainties are in the range of ±0.2 magnitude. These data are far superior to

60 **PLANETARY NEBULAE** **60**

RA h m s	Dec ° ′ ″	Name	Diam ″	Mag (P)	Mag (V)	Mag cent ★	Alt Name	Notes
03 47 33.1	+35 02 45	IC 351	18	12.4	11.9	15.8	PK 159−15.1	Mag 9.6v star SE 3′.4.
03 56 22.1	+33 52 27	IC 2003	20	12.6	11.4	15.0	PK 161−14.1	Mag 13.4 star on SW edge; close pair of stars, mags 10.04v and 10.9, NE 2′.9.
04 09 16.9	+30 46 34	NGC 1514	132	10.	10.9	9.4	PK 165−15.1	Strong dark patch S of central star.
03 45 26.6	+37 48 53	PN G156.9−13.3	34			17.7	PK 156−13.1	Mag 14.4 star on SW edge; mag 12.1 star SSE 1′.3.
04 39 48.0	+36 45 39	PN G165.5−6.5	13	13.7		18.5	PK 165−6.1	Mag 14.4 star NNE 1′.9; mag 14.3 star W 3′.5.
04 42 53.9	+36 06 50	PN G166.4−6.5	12	17.9		17.0	PK 166−6.1	Mag 10.38v star N 1′.5; mag 13.5 star E 2′.3.
04 36 37.4	+33 39 27	PN G167.4−9.1	13	15.4		15.3	PK 167−9.1	Mag 14.1 star SW 0′.6; mag 12.3 star SW 2′.4.

This is a segment of the planetary nebulae table from the *Deep Sky Field Guide* that accompanies *Uranometria 2000.0's* Map 60. The accompanying text describes the content of each column.

early photographic estimates in blue light, most of which date from the 1930s. Since the photographic-blue magnitude does not include the visually dominant [OIII] emission, it is usually too faint by one to three magnitudes compared with the appearance to the eye.

- Diameters. Given in arcseconds, these are mostly from measures on various photographic plates. Because they have not been reduced to any uniform system, these values do not refer to any fixed brightness level of the nebulosity and hence should be considered approximate only. They usually refer to the bright, well-defined portion of the object, excluding extremely faint coronae visible on images reaching to very low light levels.
- Central star magnitudes. These are, for the very brightest stars, independent of any associated nebulosity. Although based on the most recent work, these magnitudes may, however, be subject to substantial error due to the brightness of the enveloping nebula. Brighter than about 14th magnitude, they are quite reliable to better than 0.1; fainter than this, the majority are good to within ±0.5 magnitude. Since few of these stars are brighter than magnitude 12.0 and since they are associated with nebulosity, they are most difficult to observe. Good results can be achieved at high telescopic magnifications, which have the effect of reducing the apparent brightness of the surrounding nebulosity while accentuating the central star.
- Alternate names. These are provided for all planetary nebulae which, of all deep-sky objects, suffer the most from an overabundance of alternate or secondary names. In the DSFG, as with *Uranometria 2000.0*, the name precedence is as follows: *New General Catalogue* (NGC), *Index Catalogue* (IC), and PN G from the *Strasbourgh/ESO Catalogue of Planetary Nebulae*. All planetaries have a PN G number assigned. Where an object has either an NGC or IC number, the alternate name will be its PN G designation. For objects with a PN G number as a primary name, the PK number is usually given as an alternate. An exhaustive cross-reference may be found in Hynes' *Planetary Nebulae*. Note also that some planetaries have Abell names and these should not be confused with similarly named galaxy clusters. Examples of these can be found in the notes for Charts 8 and 26 among others.
- Notes. These comments primarily point out two or more stars close by each planetary, giving their magnitudes, distance and direction from the object, to aid the observer in pinpointing the exact location of what is often an almost stellar target; or, on the other hand, to a planetary that might be quite large, faint and diffuse. The notes may also contain brief descriptions, where warranted, based on DSS images. Also, nonstellar objects whose names appear in bold type are not plotted on the charts, nor do they have data in the tables; however, direction and distance to these objects will be provided in the notes. Nonstellar objects whose names are in normal type will be found on the charts and will have an entry in the tables..