SCHNEIDER: The radial velocity dispersion of PN both in our Galaxy and in M 31 appears to be greater than 70 km s^{-1} out to at least 3 kpc from their centres, so I would question your distance scale.

GATHIER: From the distribution of PN as a function of Galactic longitude, we estimate that 80% of the objects in our sample are close to the Galactic centre. Allowing for the fact that most of our objects have high radial velocities, in excess of 150 km s^{-1}, we estimate that at least 90% are close to the Galactic centre.

BIRTHRATE OF PN

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Recent observations of planetary nebulae have called into question the Shklovsky method of measuring distances. For those planetaries for which independent distance and electron density determinations are available, it is found that the ionized mass and the radius are linearly correlated (Maciel and Pottasch, 1980) and also that the ionized masses increase with decreasing electron density (Pottasch, 1981). These relations imply that the nebulae are optically thick in Ly continuum radiation and the distances based on the Shklovsky method are overestimates. Using an empirically determined mass-radius relationship Maciel and Pottasch have obtained new distances for the nebulae in the catalogue of Milne and Aller (1975). We have used the more complete catalogue of Cahn and Kaler (1971) to obtain distances corrected for possible variations in the ionized mass and have compiled a new list of local planetaries. We obtain a surface density of 15 ± 3 kpc^{-2} and a planar number density of 44 ± 4 kpc^{-3}.

Using the galactic centre PN density derived by Isaacman (1981) and the local density determined here, a radial scale factor of 2.16 kpc is obtained which leads to a total number of 28 000 in the Galaxy. The lifetime of planetary nebulae has been calculated keeping in mind that initially they are optically thick. Assuming that the ionizing photon luminosity remains constant it is found that the lifetime is more or less independent of the ionizing luminosity and the shell mass. The derived lifetime yields a birthrate of $(2.4 \pm 0.2) \times 10^{-3}$ kpc^{-3} y^{-1} for planetaries in the solar neighbourhood. Theoretical estimates of the birthrate based on the Initial Mass Functions due to Lequeux (1979) and Miller and Scalo (1979) are consistent with the observational birthrate.

Isaacman, R.B.: 1981, Astron. Astrophys. Suppl. 43, 405.
Lequeux, J.: 1979, Astron. Astrophys. 80, 35.
Maciel, W.J. and Pottasch, S.R.: 1980, Astron. Astrophys. 88, 1.
Miller, G.E. and Scalo, J.M.: 1979, Ap. J. Suppl. 41, 513.
Milne, D.K. and Aller, L.H.: 1975, Astron. Astrophys. 38, 183.
Cahn, J.H. and Kaler, J.B.: 1971, Ap. J. Suppl. 22, 319.
Pottasch, S.R.: 1981, in Physical Processes in Red Giants, ed. I. Iben Jr. and A. Renzini, D. Reidel, p. 147.

SERRANO: What is the mass range you have taken when calculating the birthrate of PN from the IMF? If your rate is lower than that predicted by integrating the IMF, may we conclude that not all stars in that mass range (particularly low mass stars) give rise to PN.

MALLIK: The birthrate of PN is equated to the observed deathrate of main sequence stars between 0.95 $M_\odot$ (corresponding to an age of 9×10^9 or 10^{10} y) and M_u, with $1 \lesssim M_u \lesssim 5\ M_\odot$. Contributions of more massive progenitors do not change the rate much in view of the steepness of the IMF towards lower masses; but the possibility that a fraction of the lower mass stars does not pass through the PN phase cannot be ruled out.

WEIDEMANN: About 30% of the White Dwarfs with masses below 0.55 $M_\odot$ have not evolved through the PN stage - thus the lower mass limit will be above 1 $M_\odot$. As to the high mass limit, new results of Reimers and Koester (1982, Astron. Astrophys., in press) show the presence of White Dwarfs with progenitor masses up to 7 $M_\odot$ or 8 $M_\odot$, all the way to the beginning of non-degenerate carbon burning.

TERZIAN: Dr. Daub, who is not present, recently derived that there are 14 000 PN per 10^{11} $M_\odot$ of Galactic matter. Hence, for a Galactic mass of 2×10^{11} $M_\odot$, we expect 28 000 PN, in agreement with your value.

WEINBERGER: Why did you exclude PN with linear radii greater than 0.4 pc?

MALLIK: The mass-radius relation of Maciel and Pottasch was established within the range of radii 0.01 - 0.40 pc. Beyond 0.40 pc, there is large scatter and distances become uncertain.

PEIMBERT: How did you determine the mass density distribution of the Galaxy?

MALLIK: The surface density distribution of PN in the Galaxy was determined essentially from two points: the value give by Isaacman for Galactic centre PN and the local surface density derived here. Based on a distance to the Galactic centre of 9 kpc, this leads to a radial scale factor of 2.2 kpc.