A SEARCH FOR PULSATIONS IN O VI PLANETARY NUCLEI

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The first two pulsating central stars of planetary nebulae to be discovered were those of K 1-16 (Grauer & Bond 1984) and Lo 4 (Bond & Meakes 1990). They are nonradial, multiperiodic g-mode pulsators, with typical periods near 25–31 min. They are O VI nuclei or related objects, with extremely high temperatures ($T_{\rm eff} \gtrsim 100,000$ K), hydrogen deficiency, and high abundances of C and O.

We have used CCD time-series photometry to search for pulsational variability in 20 additional planetary nuclei with O VI or "PG 1159"-type spectra, using the 0.9-m and 1.5-m telescopes at KPNO and CTIO. Four new pulsators have been discovered and observed more intensively: NGC 1501, 2371-2, and 6905, and Sanduleak 3. A few details are given below.

NGC 1501 shows pulsation amplitudes of up to 0.1 mag (peak-to-peak). Power spectra from four observing runs show considerable changes in the mode structure. (Such changes in pulsation amplitudes and frequencies, on time scales of a few months, appear to be a general property of pulsating PNNs.) A 1524-sec (25.4-min) mode was present during all four runs. **NGC 2371-2** showed very low-amplitude variations (if any) in October 1989, but obvious pulsations (amplitude up to $\sim$ 0.07 mag) in April 1990. The strongest mode in the April 1990 data is at a period of 983 sec (16.4 min). **NGC 6905** shows pulsation amplitudes of up to $\sim$0.1 mag. Power spectra calculated from data taken only 4 months apart are very different. The strongest pulsation modes have periods of 875 sec (14.6 min) and 710 sec (11.8 min). **Sanduleak 3** is a 13th-mag field star, classified as a "WO"-type Wolf-Rayet star. Our discovery of pulsations similar to those of O VI nuclei establishes Sand 3 as a low-mass pre-white dwarf, rather than a high-mass W-R star. The power spectra show a rich mode spectrum, dominated by a peak at 932 sec (15.5 min).

Pulsations have not been detected in the following O VI or PG 1159 planetary nuclei: NGC 246, 2452, 2867, 5189, 5315, and 6751; IC 1747, Abell 30 and 78, Ba 1, He 2-55, IW 1, Jn 1, M 3-30, PB 6, and VV 47.

References

Bond, H.E., and Meakes, M.G. 1990, AJ, 100, 788
Grauer, A.D., and Bond, H.E. 1984, ApJ, 277, 211