THE CENTRAL STARS OF He 2-131 AND He 2-138: PHOTOMETRIC VARIATIONS

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The central stars of the planetary nebulae He 2-131 and He 2-138 show variations in their visual magnitudes, with amplitudes of about 0.1 mag. and time scales of a few hours. This behavior appears to be very similar to that exhibited by the central stars of IC 418 and IC 4593. These four central stars have several other characteristics in common: a relatively low effective temperature, between 27000 and 40000 K; clear spectroscopic evidences of mass loss, both in the ultraviolet (IUE) and visible spectral regions; and short-term spectroscopic variability, in the form of radial velocity variations and/or of substantial changes in emission and P-Cygni-type line profiles. None of these central stars has shown convincing evidence of binarity; we attribute their behavior to variations in the stellar winds.

It is interesting to contrast these variations against those exhibited by massive early-type stars. These massive and luminous counterparts are well known to show spectroscopic wind variations with similar time scales. However, at least sometimes these variations are not accompanied by photometric variations in the Paschen continuum. The LBV's (luminous blue variables) do show photometric variations of similar amplitudes, but apparently with much longer time scales. Since the physical mechanism responsible for the variations is not unambiguously identified, the photometric variations in central stars of planetary nebulae may become a very useful constraint for the hydrodynamic modeling of hot star winds. A satisfactory theory must explain the photometric behavior of all hot stars, massive or not.

Suggestions of observational programs which may help to better define the problem are, for example, to verify the existence or absence of similar variations in low-temperature central stars with weaker winds, and in central stars with surface temperatures in the range from 60000 to 100000 K. Multi-color photometry would permit to check if there are detectable temperature variations in the cooler variables, like He 2-138.

One of the main difficulties in this kind of studies is the lack of observations covering a sufficiently long, uninterrupted time interval. Observations with the "whole Earth telescope" or similar consortia might be useful to learn more about the time behavior of the variations. Of course it would be desirable to obtain, simultaneously, high-resolution spectrograms; this complement would be very difficult to organize, but it would provide important information for a better description of the phenomenon.