# LINE-PROFILES OF F SUPERGIANT STARS AS CANDIDATES OF PROTO-PLANETARY NEBULAE

S. TAMURA, M. TAKEUTI and J. ZALEWSKI
*Astronomical Institute, Tohoku University, Aobayama, Sendai 989, Japan*

In this report the results of spectroscopic observations on selected F supergiant stars as the candidates of proto-planetary nebulae (PPNs) are presented. Volk and Kwok(1989) selected nearly one hundred new candidates of PPNs based upon the scenario on the evolution of them. They summarized four classes of stars which should be the PPNs and are described in various papers. These are (i) High galactic latitude supergiants, (ii) Nonvariable OH/IR stars, (iii) Low color temperature infrared objects, and (iv) R CrB. In order to examine the extended envelope of the PPNs we have started our project to obtain the H$\alpha$ profile which should give us some clue to the structure of the envelope. We are mainly concerned with F supergiant stars. Our sample objects are mostly classified as pulsating or semiregular variables.

In August 1990 and February 1991 we observed 7 selected F supergiant stars suggested in the literatures as the candidates for PPNs including UU Her as a typical sample of F-type supergiants. Stellar samples are listed in Table I and were mostly chosen from Volk and Kwok (1989, Table 1) and

TABLE I
The List of Observed Stars

| Star Name | Other desig. | RA | DEC | l | b |
|---|---|---|---|---|---|
| HD 46703 | SAO 25845 | 6 33 49.3 | +53 33 36 | 162 | +20 |
| | BD+53 1040 | | | | |
| HD 56126 | SAO 96709 | 7 13 25.3 | +10 05 09 | 207 | +10 |
| UU Her | SAO 65424 | 16 34 12.2 | +38 04 05 | 64 | +41 |
| | BD+38 2803 | | | | |
| HD 161796 | SAO 30548 | 17 43 41.3 | 50 03 48 | 77 | +31 |
| | BD+50 2457 | | | | |
| HD 163506 | SAO 85545 | 17 53 24.0 | +26 03 23 | 51 | +23 |
| | 89 Her | | | | |
| IRAS 18095+2704 | — | 18 09 31.0 | +27 04 30 | 54 | +20 |
| HD 179821 | SAO 124414 | 19 11 25.0 | +00 02 18 | 36 | −05 |
| | AFGL 2343 | | | | |
| HD 187885 | SAO 163075 | 19 50 00.7 | −17 09 38 | 24 | −21 |

from Luck and Bond (1984). We have obtained various types of H$\alpha$ profiles.

*Astrophysics and Space Science* **210**: 159–161, 1993.

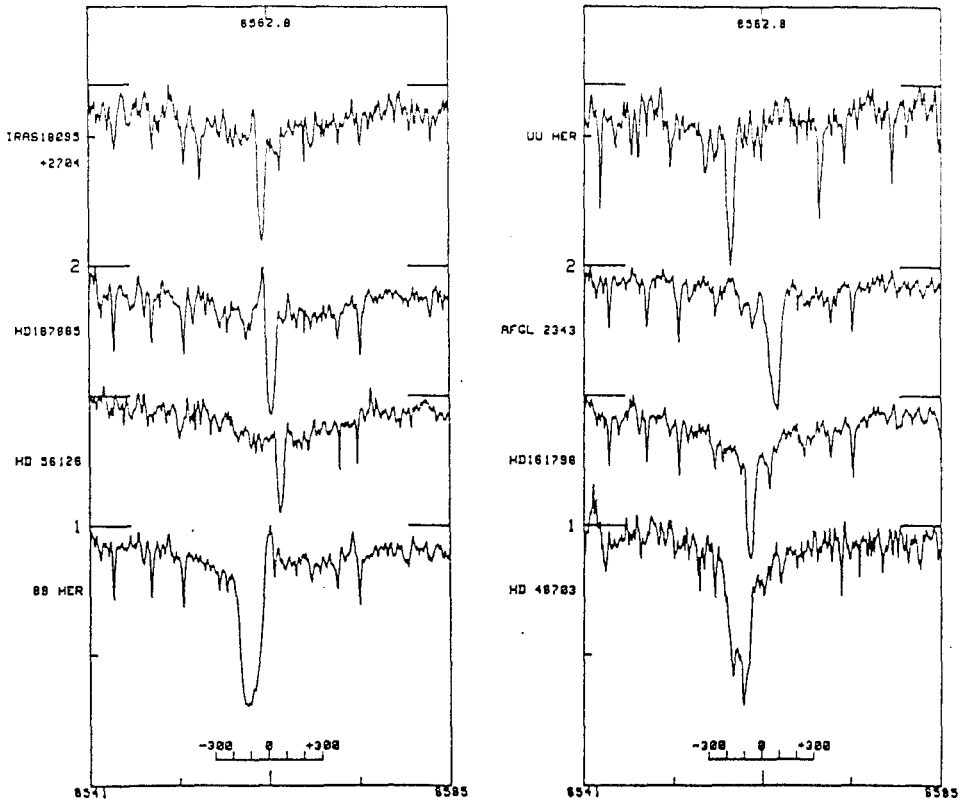


Fig. 1. Obtained Hα profiles of eight F supergiant stars. The abscissa is the wavelength referred to the heliocentric system together with the velocity scale. The ordinate is an arbitrary intensity.

They are displayed in Fig. 1. The express report and a short discussion about these stars was already presented by Tamura and Takeuti(1991) and more detailed description on observed data are given in another place (Tamura et al. 1992) together with related data previously obtained.

*a. Types of Hα profiles:* As shown in Fig. 1, the Hα profiles consist of absorption and emission components in complicated way. They show clear evidence of activity of extended atmosphere and they are considered to be candidates of PPNs.

*b. Time variations:* In addition to a wide variety of the Hα profiles we have noticed their time variations ranging over different time spans.

https://doi.org/10.1017/S0252921100014093 Published online by Cambridge University Press

*c. Radial velocities:* We can identify a couple of absorption lines like the FeI$\lambda$6569, FeII$\lambda$6516, and CI$\lambda$6587 as well as the H$\alpha$ in the wavelength range of our spectra. We have estimated the radial velocities for our sample stars.

## References

Luck, R. E. and Bond, H. E.: 1984, *Astrophysical Journal* **279**, 729.
Tamura, S. and Takeuti, M.: 1991, *IAU Inform. Bull. Variable Stars*, No. 3561.
Tamura, S., Takeuti, M., and Zalewski, J.: 1992, *Sci. Rep. Tôhoku Univ.* Ser. 8, **13**.
Volk, K. M. and Kwok, S.: 1989, *Astrophysical Journal* **342**, 345.