

DECIPHERING FG SAGITTAE*

(Abstract)

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Dr Kraft has just described a unique astronomical object – FG Sagittae – a new rosetta stone. It is our aim here to attempt to decipher this rosetta stone.

The four major observations on FG Sge, (i) the existence of a planetary nebula, (ii) the apparent brightness increase since the last century, (iii) the extremely fast, continued increase in spectral type, and (iv) the observed surface abundance increases with their respective time scales of ~ 6000 , ~ 100 , most likely 100, and 1 years, can all be explained in terms of helium-shell flashes. The last flash occurred on the order of 100 years ago, causing the spectral type change but essentially no intrinsic luminosity change. The mass of the carbon-oxygen core is $\sim 0.8 M_{\odot}$, that of the helium-rich intershell region of the order of $4 \times 10^{-3} M_{\odot}$, and if the abundances of FG Sge indeed become close to that of the barium star ζ Cap, the envelope mass is less than $\sim 0.5 M_{\odot}$, which assigns an upper limit to the present mass of FG Sge of $1.3 M_{\odot}$.

The observed abundance increases with the present leveling-off can be interpreted by two types of convective behavior of ‘convectively unstable’ envelopes deepening into regions which had been enriched in *s*-process products in previous flashes. When the ratio of the masses of the originally unenriched to the enriched part of the mixing envelope is small, the leveling-off can be understood by a deepening of the ‘convective’ envelope only; when that ratio is large, there must be a link-up of the outer with an inner intershell convective zone. One major difficulty that still remains is which mechanism could produce ‘convective’ mixing in a supergiant envelope of spectral type as early as F.

Predictions are that lithium lines may show up in the next few years if a few conditions are met. No ^{13}C enhancement should be seen**.

* This paper was presented by I.-J. Christy-Sackmann and was supported in part by the National Science Foundation (GP-36687X, GP-28027).

** There have been revisions in this report since Warsaw.