THEORETICAL ABUNDANCES IN PLANETARIES

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A satisfactory model of the formation of planetaries should explain the observations indicating that nitrogen and carbon in planetaries are overabundant by about one order of magnitude. These large abundances imply that substantial fractions of the galactic nitrogen and carbon originate from planetaries; one should then also investigate if the low value of the ratio C^{13}/C^{12} measured on the Earth is compatible with an assumed dominant rate of the CNO cycle in the formation of planetaries.

We have studied these questions in the framework of our model of the formation of planetaries; according to this model the progenitors of planetaries are fully degenerate stars with hydrogen-rich outer shells containing the building material of the nebulae. The energy needed to eject these shells is provided by partial hydrogen burning through the CNO cycle. We can explain the observed abundances only if central stars have masses $\lesssim 0.5\ M_{\odot}$. This result is consistent with another result of our model, that planetaries ejected by heavier stars should have abnormally low masses; therefore, they should be difficult to observe and should have little influence on galactic abundances. (Paper will appear in Astronomy and Astrophysics.)

ALUMINUM, TITANIUM AND MAGNESIUM ABUNDANCES IN PLANETARY NEBULA IC 2149

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The relatively strong emission lines belonging to the singly ionized aluminum, titanium and magnesium are discovered on the shortwave spectrogram of planetary nebula IC 2149 obtained with the help of space observatory "Orion-2". These lines are: 2669 AlII, 3080 TiII and 2800 MgVI. At the same time this is the first evidence on the presence of chemical elements of aluminum, titanium and even magnesium (if we do not have in view the early identification of one very faint line, 4571 MgI, in the spectrum of NGC 7027) in the composition of the planetary nebulae. As a result, the number of chemical elements discovered in planetary nebulae until now reaches up to 19 (from 16).

2669 AlII is a resonance line, 2800 MgII - a resonance doublet, and 3080 TiII is identified with the multiplet No. 5 of ionized titanium,

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consisting of 9 lines, four of the strongest (3066, 3073, 3078, 3088 Å) are resonance. For all of these lines the low excitation potentials (4 - 4.5eV) from the ground levels is the most characteristic feature. Just this circumstance determines the general mechanism of the excitation of these lines. Particularly, it is found that in contrast to the usual lines of fluorescence origin, these three groups of lines are excited by the same mechanism as the forbidden lines, that is by the inelastic electron collisions.

Using the known collisional parameters for corresponding transitions, bringing to the origin of the lines 2669 AlII and 2800 MgII, the relative abundances of aluminum and magnesium in the nebula IC 2149 are obtained. The results are $N(Al)/N(H) = 0.3\times10^{-6}$ and $N(Mg)/N(H) = 0.4\times10^{-5}$. For the Sun the corresponding abundances are: 1.6×10^{-6} and 2×10^{-5}, that is aluminum and magnesium are nearly five times less abundant in IC 2149 than in the Sun.

As to the titanium, because of the absence of the corresponding collisional parameters for the components of the multiplet No.5, it is not possible to determine its abundance.

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