CARBON PLANET MODEL WITH SiC MANTLE COMPOUND. P. Futó[1] & A. Gucsik[2,3], [1]Csorna, 15 Szt. István square, H-9300, Hungary, (E-mail:dvision@citromail.hu); [2]Department of Earth and Planetary Materials Science, Graduate School of Science, Tohoku University, Sendai 980-8578, Japan; [3]Konkoly Observatory of the Hungarian Academy of Sciences, H-1121 Budapest, Konkoly Thege Miklós út 15-17., Hungary

Introduction: Carbon planets should form in carbon rich environments, where the C/O ratio is equal or larger than 1 [1]. The Solar carbon abundance ratio is C/O= 0,5 [2]. Theoretically, carbon planets could form around pulsar by means of the second-generation planet formation. Moreover, a CO planet may potentially form in environments of the white dwarf stars [3-5]. The compositions of these planets are very different from silicate-rich planets of our Solar System. Mantle and crust of a carbon planet composed of carbides or graphite, probably. In their interiors, silicon-carbide (SiC) is the most abundant form of carbon-rich minerals. Silicon carbide (SiC) grains from the AGB (Asymptotic Giant Branch) stars show the isotopic ratios of C, N, and the heavy elements (Sr, Zr, Mo, etc), which are dominated by the stellar nucleosynthesis. The elements Si and Ti carry signatures both the original composition of the parent star (Galactic evolution) and neutron capture (AGB nucleosynthesis). In order to demonstrate of their internal structure, we have made a structure model for a 5 $M_\oplus$ carbon planet.

Model: We computed the planetary structure of a 5 $M_\oplus$ carbon planet using by numerical methods concerning the homogeneous spherical shells. In our model, the case of carbon planet is 32,59% of the complete mass and it contains 75% Fe, 15% Ni and 10% C, respectively. The complete mantle composed of silicon-carbide and the compounds of crust are carbon rich minerals. For comparison, we have performed the mass-radius modeling for the 5 $M_\oplus$ planets in case of an Earth-type and a coreless terrestrial-type planetary structure. We used the derived interior models of silicate and carbon planets to investigate the mass-radius relationships considering the material features of iron, silicate and carbon compounds. The depth-dependence of density and pressure can be described by the following relationships:

$$\frac{d\rho}{dr} = \frac{\rho(r)g(r)}{\phi(r)} \qquad (1)$$

$$\frac{dP}{dr} = -G\frac{M(r)}{r^2}\rho(r) \qquad (2)$$

Where KS is the adiabatic bulk modulus that can be calculated by an equation of state (EOS), G is the gravitational constant and r is the distance from the planet center.

Results: For the case of Earth-like size and core mass fraction (CMF) their radius and average density will differ from those of the Earth because the average density of silicon carbide mantle is less than that of the silicate mantle. The obtained parameters for the mass-radius relation and planetary structure are as follows: the radius of core-mantle boundary (R_{CMB}) is 5418 km and the total radius of this 5 $M_\oplus$ carbon planet is 10506 km. If we assume that their masses are equal the diameter if modeled carbon planet is about 1,07 times larger than a terrestrial-planet, which have Earth-like structure. At the same time, we ascertained that the diameter of our carbon planet model is approximately 1,02 times less than a 5 $M_\oplus$ coreless silicate planet (Fig. 1).

a) **b)**

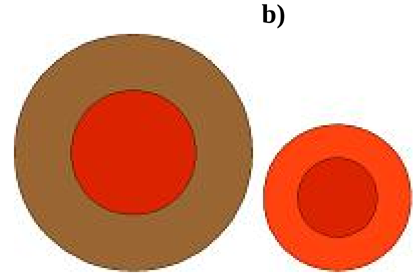

Figure 1. *a) Structure model for a 5 $M_\oplus$ carbon planet. Its composition differs from that of Earth: the case of $Fe_{0,75}$,$Ni_{0,15}$,$C_{0,1}$, the complete mantle composed of silicon carbide and in much less part titan carbide. The top boundary layer (crust) includes silicon-carbide, titan-carbide, furthermore it may exists a diamond layer underneath the crust. b) represents the Earh-structure for comparison.*

Summary: The existence of carbon planet is very probable by reason of astrophysical consideration. For the case of the same mass and CMF ratios their diameters are slightly larger than that of a terrestrial planet. Using by the data of precise measurements we will more accurately derive theoretical and compositional approximations for the planetary structures.

References: [1] Kuchner M. and Seager S. 2006, arxiv: 0504214 [2] Asplund M. et al. 2005, ẠA, 431,693 [3] Livio M. et al. 1992, MNRAS, 257, 15P. [4] Vinet P. et al 1987, J. Geophysical Res., 92, 9319 [5] Vinet P. et al. 1989, J. Phys. Cond.