Carbon Dust Life Cycle in the Universe

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It is now well established that a significant fraction of the interstellar dust is represented by carbon-bearing particles having different sizes and structures [1]. This suggestion has been confirmed back in 1960s by both considerations on the possible origin of such particles [2] and by direct observational evidence [3]. However, the exact nature of carbon-bearing grains is still far from being firmly established. They may contain graphite, amorphous carbon, certain kind of aromatic compounds (vaguely referred to as polycyclic aromatic hydrocarbons, PAH [4]) as well as some more exotic components, like diamonds, fullerenes, and nanotubes. It is widely believed that evolved stars are a major source of carbon-bearing grains (see e.g. [5]). After having been expelled from a parent star, a carbon grain makes it into the interstellar medium, where it is subject to numerous processes that either destroy it [6–8] or alter its structure [9–10]. Eventual destruction of carbon grains by ultraviolet radiation of hot massive stars may increase abundances of small hydrocarbons in the interstellar gas [11]. Obviously, to follow all these transformations, one needs to construct an evolutionary model. which would account for various changes in the dust size distribution, charge state, bond structure, etc. [12].

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References

1. A.P. Jones et al., *Astron. and Astrophys.* **2013**, 558, A62.
2. F. Hoyle, N. C. Wickramasinghe, *MNRAS* **1962**, 124, 417.
3. F.C. Gillett, F.J. Low, W.A. Stein, *Astrophys. J.* **1968**, 154, 677.
4. A.G.G.M. Tielens, *ARA&A* **2008**, 46, 289.
5. I. Cherchneff, J.R. Barker, A.G.G.M. Tielens, *Astrophys. J.* **1992**, 401, 269.
6. E. R. Micelotta, A. P. Jones, A. G. G. M. Tielens, *Astron. and Astrophys.* **2010**, 510, A36.
7. E. R. Micelotta, A. P. Jones, A. G. G. M. Tielens, *Astron. and Astrophys.* **2010**, 510, A37.
8. E. R. Micelotta, A. P. Jones, A. G. G. M. Tielens, *Astron. and Astrophys.* **2010**, 526, A52.
9. M. S. Murga, S. A. Khoperskov, D. S. Wiebe, *Astronomy Reports* **2016**, 60, 233.
10. M. S. Murga, S. A. Khoperskov, D. S. Wiebe, *Astronomy Reports* **2016**, 60, 669.
11. J. Pety et al., *Astron. and Astrophys.* **2005**, 435, 885.
12. M. S. Murga et al., *MNRAS* **2019**, 488, 965.