The Circle of Dust:
From Nanoparticles to Macromolecules and Beyond

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There is increasing observational evidence that a non-negligible fraction of the cosmic carbon is locked up into macromolecules and nanoparticles. Carbonaceous nanoparticles and Hydrogenated Amorphous Carbon (HAC) nanoparticles represent one of the main components of interstellar dust. HAC nanoparticles have been proposed as a viable carrier for the Unidentified InfraRed (UIR) bands, which dominate the mid-infrared spectrum of almost any astronomical object. Fullerene molecules C_{60} and C_{70} have been detected in various circumstellar and interstellar environments.

I will present some of our recent results about the evolution of such carbonaceous structures and the possible connections between each other. I will show how photo-processing of HAC nanoparticles can lead to the formation of C_{60} and C_{70} in space. There the low density of the gas precludes the formation of fullerene materials following known vaporization or combustion synthesis routes, even on astronomical timescales[1]. I will then discuss the processing of small hydrocarbon dust by energetic ions and electrons under extreme conditions, e.g., in shocked regions[2]. Finally, I will derive the astrophysical implications of such processing in terms of the observed emission[3].

References

1) Micelotta E. R., Jones A. P., Cami J., *et al.* 2012, ApJ, 761, 35
2) Bocchio, M., Micelotta, E. R., Gautier, A.-L., Jones, A. P. 2012, A&A, 5435, A124
3) Bocchio, M., Jones, A. P., Verstraete, L., *et al.* 2013, A&A, 556, A6