

Formation History of Polycyclic Aromatic Hydrocarbons in Galaxies

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Polycyclic aromatic hydrocarbons (PAHs) are one of the major dust components in the interstellar medium (ISM). We present our evolution models for the abundance of PAHs in the ISM on a galaxy-evolution timescale. We consider shattering of carbonaceous dust grains as the formation mechanism of PAHs while PAHs can be reduced by coagulation onto dust grains, destruction by supernova shocks, and injection into star formation. We implement these processes in a one-zone chemical evolution model to obtain the evolution of the PAH abundance in a galaxy. We find that PAH formation becomes accelerated at certain metallicity which shattering becomes efficient at. For the PAH destruction, while supernova shock is primary mechanism in the metal-poor environment, coagulation is dominant in the metal-rich environment. We compare the calculated PAH abundances with the observed abundances in galaxies with a wide metallicity range. Our models naturally explain both the low PAH abundance in low metallicity galaxies and the metallicity-dependence of the PAH abundance in high-metallicity galaxies. We discuss the physical properties that play a key role in the evolution of the PAH abundance.