Carbon-rich dust in the evolved born-again planetary nebulae A 30 and A 78

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We present an infrared (IR) characterization of the born-again planetary nebulae (PNe) A 30 and A 78 using IR images and spectra. We demonstrate that the carbon-rich dust in A 30 and A 78 is spatially coincident with the H-poor ejecta and coexists with hot X-ray-emitting gas up to distances of $50''$ from the central stars (CSPNs). Dust forms immediately after the born-again event and survives for 1000 yr in the harsh environment around the CSPN as it is destroyed and pushed away by radiation pressure and dragged by hydrodynamical effects. Amorphous carbon formed in H-deficient environments, is associated with the disrupted disk around the CSPN of A 30 and A 78, providing an optimal environment for charge exchange reactions with the stellar wind that produces the soft X-ray emission of these sources. Nebular and dust properties are modeled for A 30 with CLOUDY taking into account different carbonaceous dust species. Our models predict dust temperatures in the 40–230 K range, five times lower than predicted by previous works. Gas and dust masses for the born-again ejecta in A 30 are estimated to be $M_{\rm gas} = (4.41^{+0.55}_{-0.14}) \times 10^{-3}$ M$_\odot$ and $M_{\rm dust} = (3.20^{+3.21}_{-2.06}) \times 10^{-3}$ M$_\odot$, which can be used to estimate a total ejected mass and mass-loss rate for the born-again event of $(7.61^{+3.76}_{-2.20}) \times 10^{-3}$ M$_\odot$ and $\dot{M} = [5 - 60] \times 10^{-5}$ M$_\odot$ yr^{-1}, respectively. Taking into account the carbon trapped into dust grains, we estimate that the C/O mass ratio of the H-poor ejecta of A 30 is larger than 1. The later is consistent with the born-again scenario instead of the nova-like event suggested by other authors.