The physical and compositional properties of dust: what do we really know?

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In this review talk I will try to summarise what we currently 'know' of the physical and compositional properties of dust in the interstellar medium (ISM) of galaxies. I will consider this within the framework of the dust life-cycle and the evolution of dust properties in response to local conditions.

I will discuss the *evidence* for interstellar dust (absorption, scattering, emission, elemental depletions, luminescence, polarisation, interstellar dust in the Solar System, …) and what *we have inferred* about its physical properties (chemical composition, optical properties, structure, shape, …). All of these aspects will be covered in much greater detail by following speakers and so will only be briefly summarised here so as to serve as an introduction to the later presentations.

I will focus on what we conclude of dust from *our interpretation* of the astronomical observations, including its:
- chemical composition (hydro-carbonaceous, silicate, oxide, carbide, …),
- form (amorphous, crystalline, homogeneity, …),
- structure/shape (spheroidal/ellipsoidal, irregular, aggregate, porous, core-mantle, …),
- formation (around evolved stars, in supernova ejecta and by accretion in the ISM, …).

The dust composition will be considered in detail within the context of its (re-)formation, processing and evolution in the circumstellar and interstellar media.

In particular, I will discuss the apparent need to (re-)form segregated carbon-rich and silicate-rich dust phases in the low-density ISM by an indiscriminate accretion process.
I will also try to critically evaluate the currently-used 'astronomical' dust analogue materials (amorphous silicate, 'graphite', amorphous carbons, 'PAHs', …) and suggest where, based on observations and our current knowledge, we might perhaps need to carefully review some of our current ideas. I will also underline some of the key outstanding issues/problems and remain to be resolved in the future.