Dust in spiral and elliptical galaxies

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Dust in galaxies - the basics

- Galaxies in general contain stars, gas and dust. The average mass ratios are 1000:100:1.
- In spiral galaxies, the dust is concentrated in the disk and spiral arms, while in ellipticals one often finds conspicuous dust lanes along the apparent axes.
- Dust grains are composed of graphite and silicon compounds as well as water and spurious higher element portions. Their sizes range between 0.01 and 0.1 μm.
- The combination of gas and dust often constitutes star-forming regions, e.g. Orion nebula.

How do we detect dust?

- Dust absorbs and scatters light in the UV, optical and near-infrared (NIR) regions.
- In the far-infrared (FIR) we have thermal emission of light by dust

What can we learn from dust?

- *Physical properties of dust*
  From FIR observations grain sizes, dust temperatures and distributions can be found, which leads to an understanding of dust formation and destruction
- *Physical properties of galaxies*
  By combining UV, optical and NIR observations, one finds the mass and distribution of dust. The distribution of radiation in galaxies can be evaluated by the amount of extinction caused by dust. This leads to further knowledge of galaxy dynamics and stellar populations.
- *Contributions to observational cosmology*
  From the derived properties of galaxies and populations of galaxies, one can infer global properties for the universe, such as spatial, light and mass distributions, missing mass, and values for the Hubble parameter, deceleration and density parameters (Schuecker & Ott 1991, Duemmler 1992). Ultimately this leads to conclusions concerning the evolution of the universe.

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Observations and tests

- The observations are carried out at SAAO on the 1m and 1.9m telescopes (imaging and spectroscopy) over the period 1993 to date.
- For the purpose of statistical investigations we use the photographic catalogue of the Muenster Redshift Project (Cunow 1995a and references therein).
- The tests include the comparison of surface brightness profiles of selected galaxies with model profiles assuming different amounts of dust.
- The statistical investigations comprise the comparison of projected surface brightness and colour for a selected sample of galaxies of the same morphological type with different inclination angles (Holmberg test; Holmberg 1958).

First results

- By employing a realistic three-component model (Christensen 1990) spirals and ellipticals can be described as three-dimensional distributions of dust, bulge and luminous disk (Cunow 1992, Kylafis & Bahcall 1987).
- By using photographic U, J, F and I data statistical investigations can be carried out. For spirals we find that they are optically thick in the centre but optically thin in the outer regions (Cunow 1995b).

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