Resolved analysis of gas and dust in nearby edge-on spiral NGC 891

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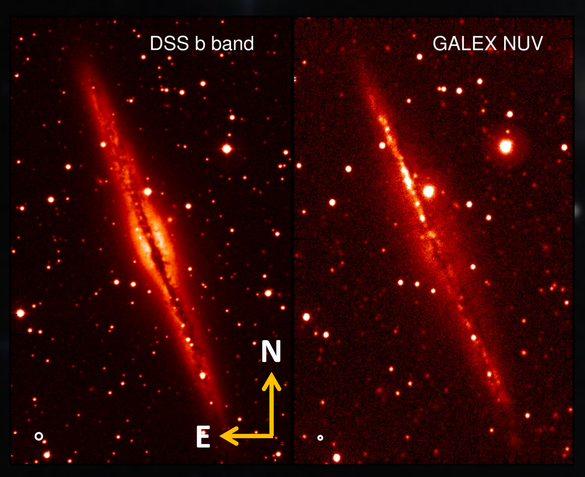
Abstract

New *Herschel* PACS and SPIRE images are combined with SCUBA observations to trace the FIR/submm SED of NGC 891. We fit one-component modified black body models to the SED on a pixel-by-pixel basis to produce maps of the dust mass and temperature. The dust mass distribution shows several peaks along the disk and only weakly correlates with dust temperature, which ranges from ≃ 17 and 23 K. Allowing the spectral index to vary, we find an average value of β = 1.9 ± 0.3. Strong spatial correlations exist between the surface mass densities of dust (Σ_{dust}) and the molecular hydrogen (Σ_{H_2}) and total gas (Σ_{gas}). These observations reveal regions of dense, cold dust that coincide with peaks in the gas distribution and are associated with a molecular ring. Furthermore, asymmetries in the dust temperature, the H_2-to-dust and gas-to-dust ratios correspond to brighter Hα and UV emission in the northern disk compared to the south. The disk asymmetry likely arises from both an enhanced SFR in the northern disk and dust obscuration in the south due to line-of-sight projection effects of the spiral arms.

1. NGC 891

·A nearby edge-on spiral analogous to our Milky Way.

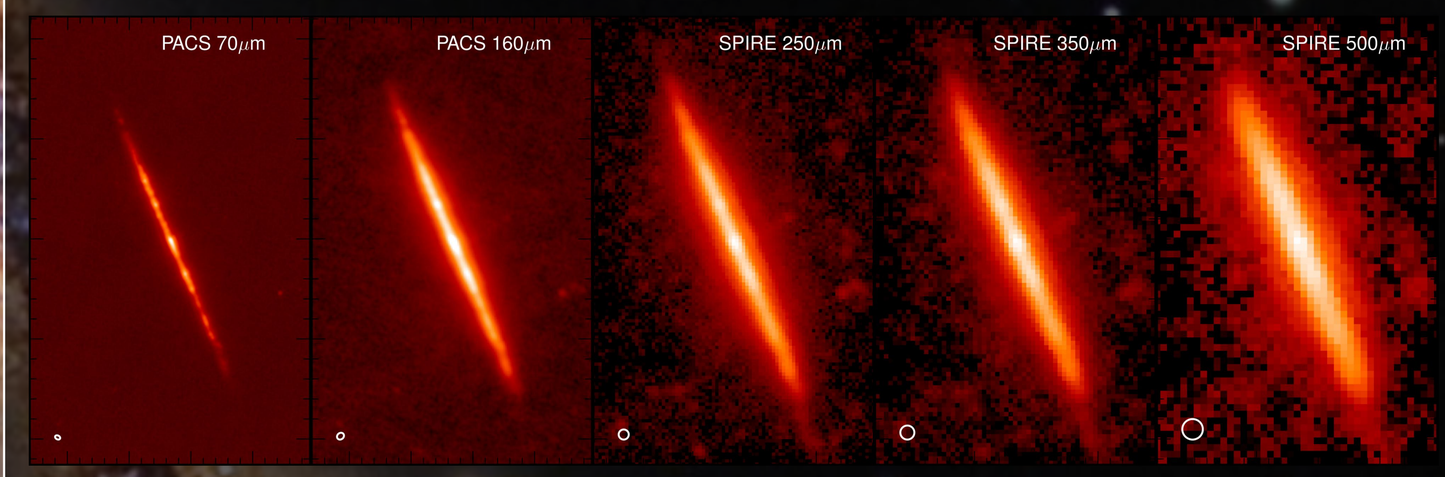


Clear asymmetry between the NE and SW sides of disk observed in the Hα & UV emission.

Is this asymmetry due to enhanced SF (Rossa et al. 2004) or just obscuration of HII regions via dust along the line-of-sight through a spiral arm (Kamphuis et al. 2007) ?

2. *Herschel* PACS / SPIRE observations

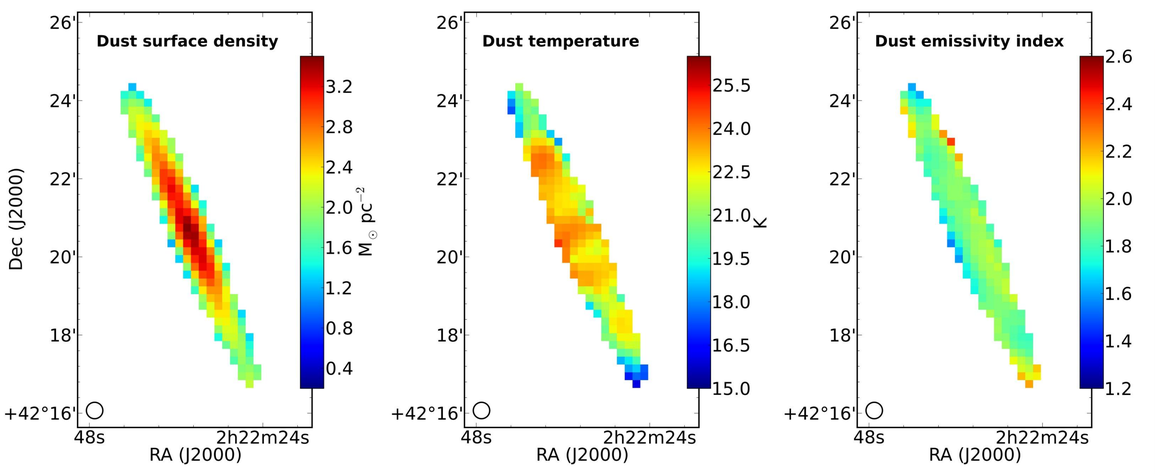
Herschel observations were obtained as part of the Very Nearby Galaxies Survey (P.I. C. Wilson).



These data are combined with JCMT SCUBA 450 and 850 μm images to trace the FIR/submm SED. Each image is then convolved and rescaled to match the SPIRE 500 μm 36'' resolution (not shown), such that the pixels of each image at each wavelength are matched.

3. Resolved dust analysis

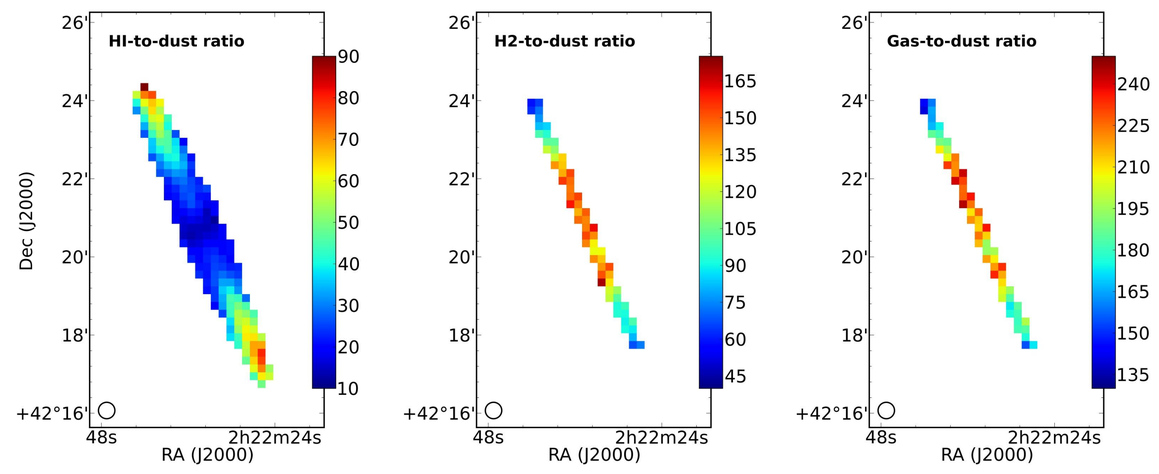
We fit one-component modified black body models to the SED of each matched pixel, taking the 70 μm point as an upper limit and allowing the emissivity index, β, to vary as a free parameter. Our resultant maps are:



The northern temperature peak matches the observed Hα & UV asymmetry.

4. Disk asymmetry in gas-to-dust ratios

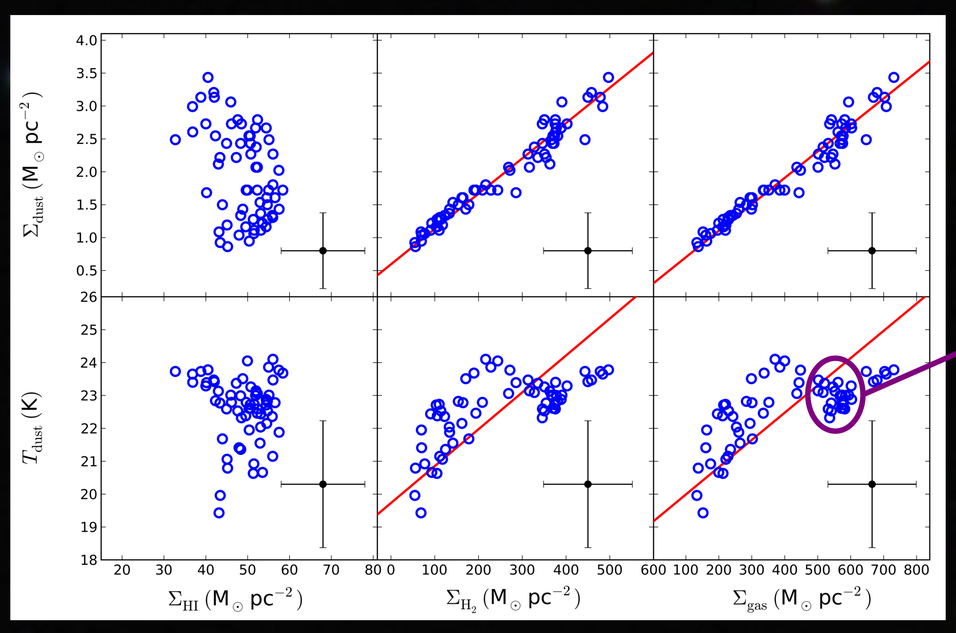
Gas surface densities were estimated from HI 21 cm and CO (J=1-0) maps from Oosterloo et al (2007) and Scoville et al (1993), respectively. We assume a constant X_{CO} conversion factor. We compare these to the dust map:

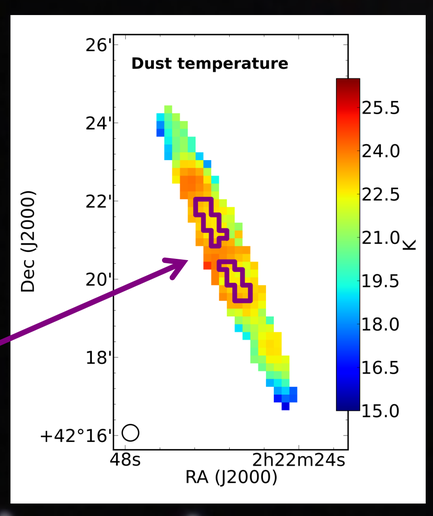


The gas-to-dust ratio peak also matches the observed Hα & UV asymmetry.

5. The dust – gas connection: tracing a molecular ring

We find strong spatial correlations between the surface mass densities of dust (Σ_{dust}) and the molecular hydrogen (Σ_{H_2}) and total gas (Σ_{gas}), but no correlation with the atomic gas (Σ_{HI}).





"Cooler-than-expected" points form regions coincident with H_2 ring (see Scoville et al. 1993).

6. Conclusions

Asymmetries in the dust temperature and gas-to-dust ratios correspond to brighter Hα and UV emission in the northern disk, suggesting the asymmetry arises from both an enhanced SFR in the north and dust obscuration in the south.

7. What next?

The same techniques for analysing NGC 891's dust properties are being applied to the seven galaxies comprising the *Herschel* Observations of Edge-on Spirals (HEROES) sample. See the poster P8 by S. Viaene for more details.

References: Kamphuis et al. 2007, A&A 471 L1; Oosterloo et al. 2007, AJ 134 1019; Rossa et al. 2004, AJ 128 674; Scoville et al. 1993, ApJL 404 L59.

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