

# **GTKP SHINING**

# Sharp Insight into the Colliding Galaxies of the Antennae: Revealing the Metamorphosis of a Whole Galaxy System

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## **Strong Activity in the Overlap Area**

6 cm radio Hummel & van der Hulst (1986)

15 μm ISOCAM Mirabel et al. (1998)



850 μm SCUBA Haas et al. (2000)

High-resolution CO Wilson et al. (2000)

### The new Herschel-PACS images at 70, 100 and 160 $\mu\text{m}$



- Scan maps, medium (20"/s) scan speed, 2 orthogonal (45°, 135°) directions, leg separation 39 arcsec (1/4 of homogeneous coverage map step size)
- Nominal 10  $\sigma$  sensitivities: ~30 mJy per pixel
- Data processing with HIPE version 3.0, build 1134, standard steps of PACS photometer pipeline 41 data samples high-pass filter, FWHM of PSF 5.5, 6.8, 11.3 arcsec





## FIR image overlay on optica (B, V, $H_{\alpha}$ ) HST images



Hidden versus visible star formation



#### **Clump photometry of emission knots**



HIIphot program by Thilker et al. (2000)



#### **Derivation of star formation properties**





modified BB fits for FIR luminosity &  $F_{1300 \ \mu m}$  determination



#### **Radio to FIR correlation**





K1: weak magnetic field/not yet enough CR e<sup>-</sup> K2a: compressed magnetic field



#### X-ray emission of FIR knots





Fabbiano et al. (2001)

weak X-ray emission from knots K1 east & K2a

#### Conclusions



- New HERSCHEL-PACS scan maps of the Antennae at 70, 100 and 160 µm provide a high spatial resolution complement to earlier MIR maps (ISOCAM, Spitzer-MIPS), high resolution CO (1-0), 6 cm radio and Chandra X-ray maps to allow for a detailed study of the star formation state
- FIR appearance of the Antennae is dominated by the arc of knots between NN(4038) and K1, NS(4039) appears only as an appendix; no two individual galaxy systems anymore as still recognizable in the optical
- HIIphot clump photometry  $\Rightarrow$  sizes, luminosities, SFR & SF densities:
  - $L_{FIR}(K1) \sim L_{FIR}$  (Milky Way), size = 4.7 kpc<sup>2</sup>, K1 is most active SF region
  - dust heating in overlap region knots stronger than in blue arm knots, also in K2 active SF is ongoing
- Inter-comparison with CO(1-0), radio, and X-ray maps:
  - K1 (east): weak X-ray, radio deficiency  $\Rightarrow$  very young;
  - K2a: very obscured, weak X-ray, radio excess ⇒ also very young with possibly compressed magnetic fields but lower SFE than K1;
    K2b+c already more evolved
- Results will appear in special HERSCHEL A&A issue; within GTKP SHINING ~40 interacting galaxy systems will be imaged with PACS