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Survey of lines in M 31: [CII] as SFR tracer at ∼ 50 pc scales

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The [CII] 158 μm line is typically the brightest far-IR emission line from star-forming galaxies. As such, this line is a possible tracer of star-formation, but to do so we need the relative contributions of different ISM phases. Using high physical resolution observations of the [CII] 158 μm line from *Herschel* PACS in five 3'×3' field in M 31 and optical IFU spectra from PPaK and ancillary IR data, we are able to spatially separate out the ISM phases (Kapala *et al.* subm.). We find that a large fraction of [CII] emission in M 31 arises from diffuse gas (∼20–90%), with a sub-linear relation of [CII]–SFR at ∼50 pc scales. However, on ∼kpc scales, the observed empirical [CII]–SFR relation is in agreement with other extragalactic studies. The observed flattening of the fitted slope to the [CII]–SFR at ∼50 pc scales might be explained by possible contributions to ISM gas heating by older stellar populations (ie. [CII] tracing longer timescales) and/or leaked photons from HII regions. The issue of leaked photons from HII regions should go away when averaged over larger scales (>500 pc).

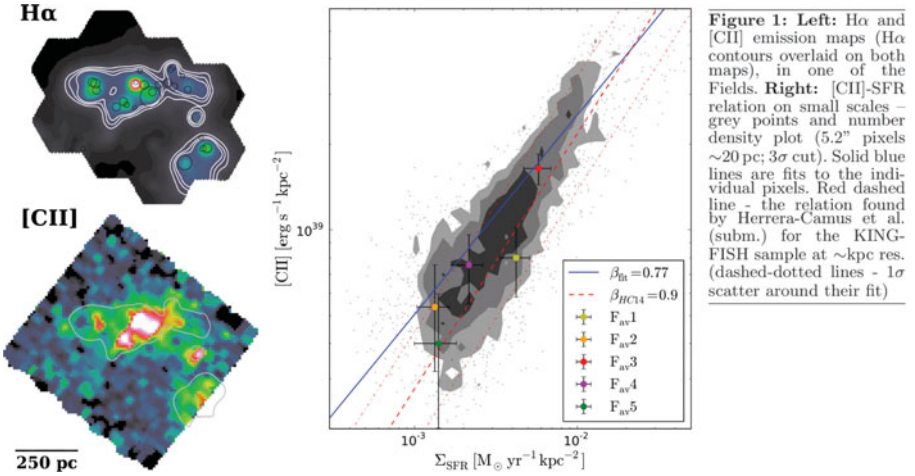

Figure 1: Left: Hα and [CII] emission maps (Hα contours overlaid on both maps), in one of the Fields. **Right:** [CII]-SFR relation on small scales – grey points and number density plot (5.2" pixels ∼20 pc; 3σ cut). Solid blue lines are fits to the individual pixels. Red dashed line - the relation found by Herrera-Camus et al. (subm.) for the KINGFISH sample at ∼kpc res. (dashed-dotted lines - 1σ scatter around their fit)

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Reference

Kapala, M. J., *et al.*, subm., *ApJ*