CII Mapper: Mapping the Milky Way in [CII]

**Science objectives:**
- Determine the relative contribution of various phases of neutral and ionized gas to the global CII emission of a galaxy; e.g. in photon-dominated regions (PDRs), HII regions, shocks, diffuse neutral and ionized gas and CO-dark molecular gas.
- Study how reliably CII emission measures the star-formation rates of the Milky Way and other galaxies.
- Construct Milky Way templates for comparison to distant galaxies.

**Telescope and payload:**
- An off-axis 1m telescope, 40" angular resolution
- 16-pixel heterodyne receiver focal plane array with a system noise temperature < 500 K @ 1.9 THz
- 16 low noise amplifiers;
- Correlator or acousto-optical spectrometers;
- Dry cooler for the array at ~5 K (< 110 W, 30 Kg)

**Chinese-European collaborations:**
- Many areas, e.g. mixer technology and optics design
- Making use of the array expertise by PMO: THz multi-beam receiver SSAR
- The existing collaborations:
  - PMO-Paris Observatories (France)
  - PMO - SRON/TU Delft (NL)
  - NAOC – KOSMA (Germany)

**Overview:**
- The bright fine structure line of CII (158 μm, 1.9 THz) is the main ISM cooling channel from galaxies
- Mapping the CII line in the Milky Way can answer key questions about Galactic evolution, e.g. revealing all molecular cloud interfaces and trace cold H₂, invisible in CO
- A [CII] Mapper using a sensitive, heterodyne receiver array will go beyond COBE and BICE in spectral resolution and beyond Herschel/HIFI and SOFIA mapping capabilities

**Top:** Lines of sight through our Milky Way probed in CII with HIFI
- Left: Example CII spectra (red) showing the complex line profiles: different clouds are seen at different velocities
- Pineda et al. (2013) and Langer et al. (2010)

**Left:** ESA Planck. CII Mapper makes use of a similar concept, but simpler, lighter and more compact
- Top: 16-pixel heterodyne receiver array designed for GUSSTO – a stratospheric balloon proposed to NASA’s SMEX program. Inset: Photo of a HEB mixer, the same HEBs as Herschel/HIFI did.

**Upper left:** French Schottky diodes for THz multiplier local oscillators
**Lower panel:** 1.9 THz solid state multiplier local oscillator by JPL for Herschel

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