Dust Temperature Profiles of Isolated Star-Forming Cores: Herschel Observations of Bok globules CB244 and CB230

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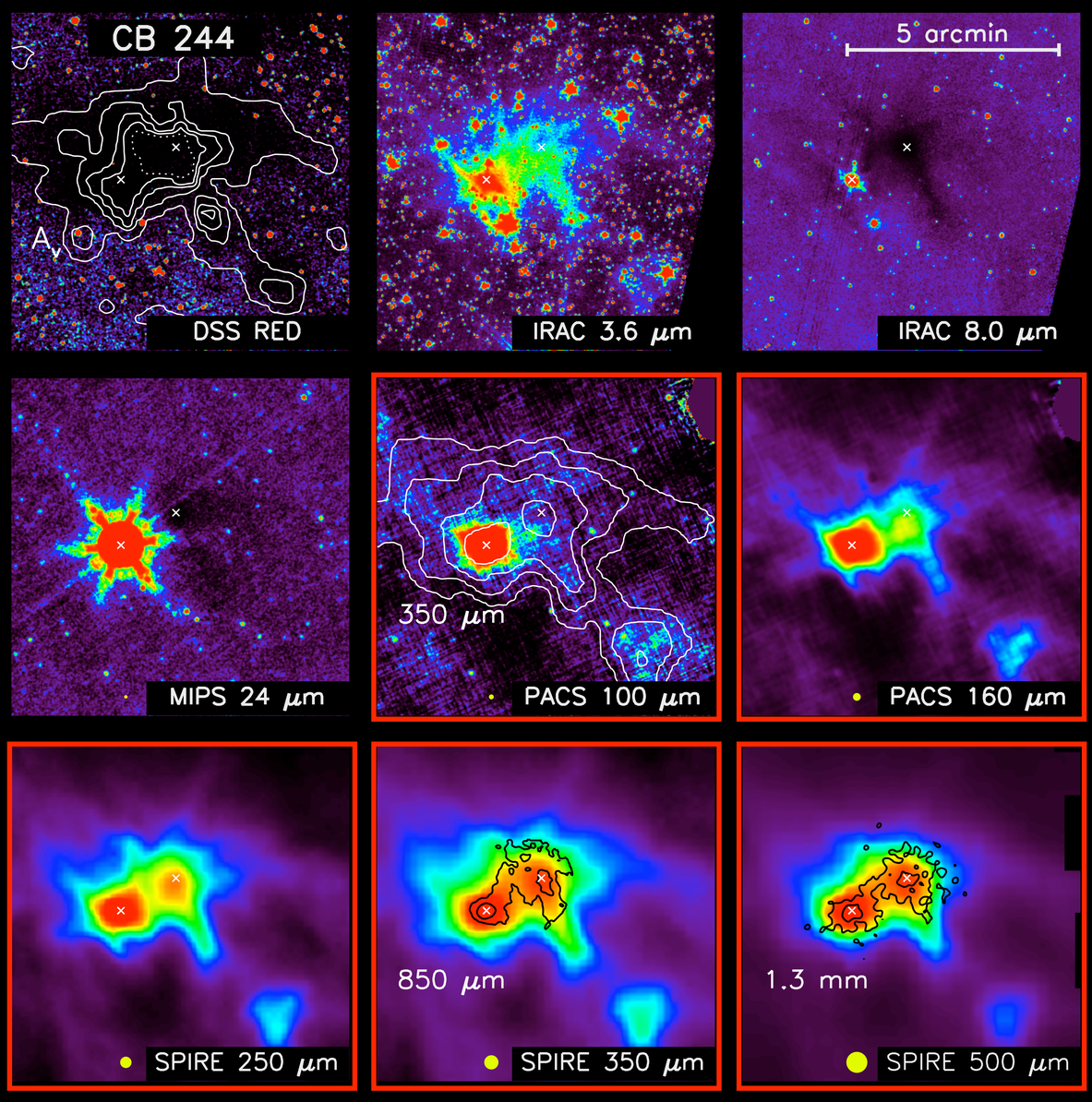
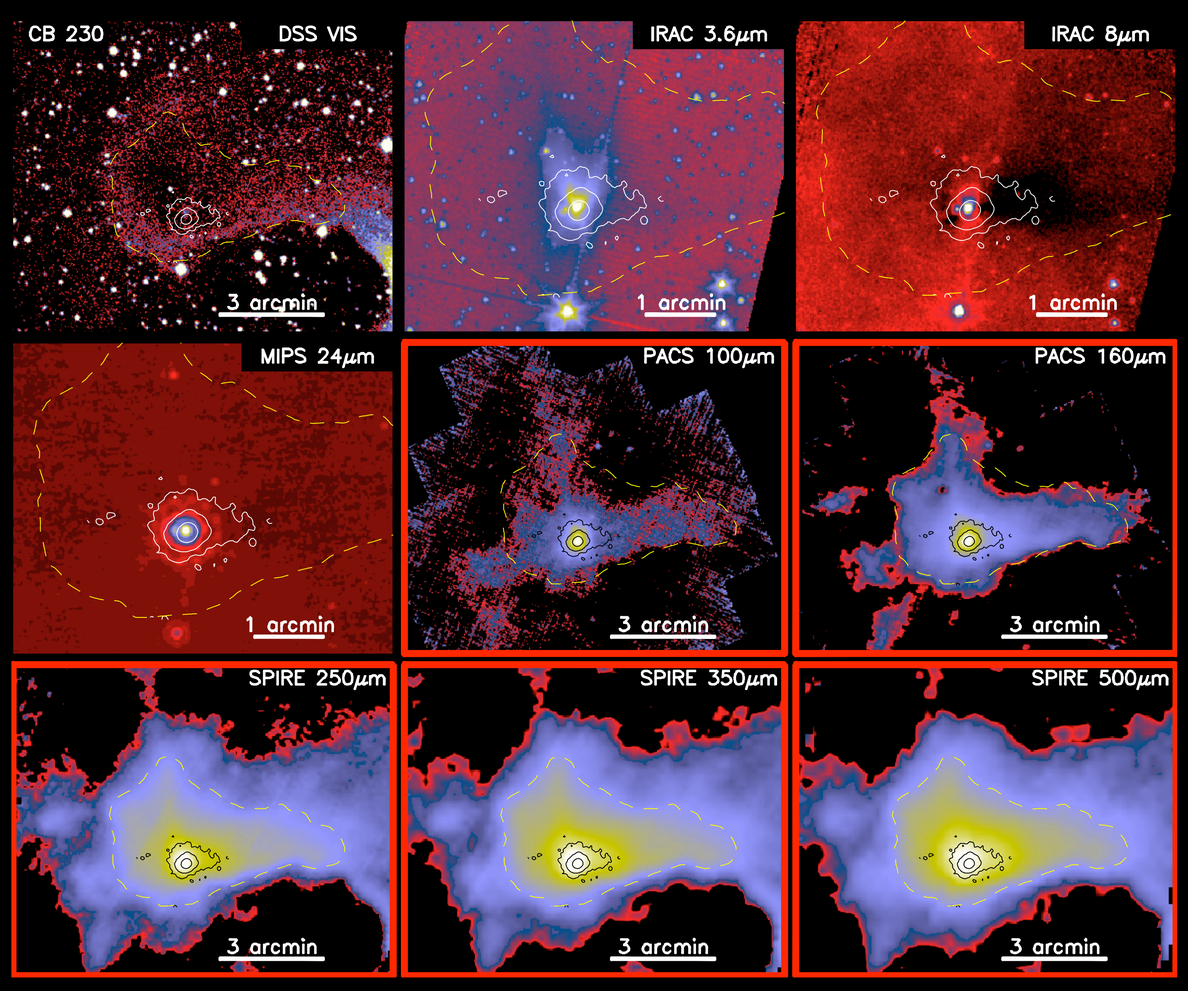
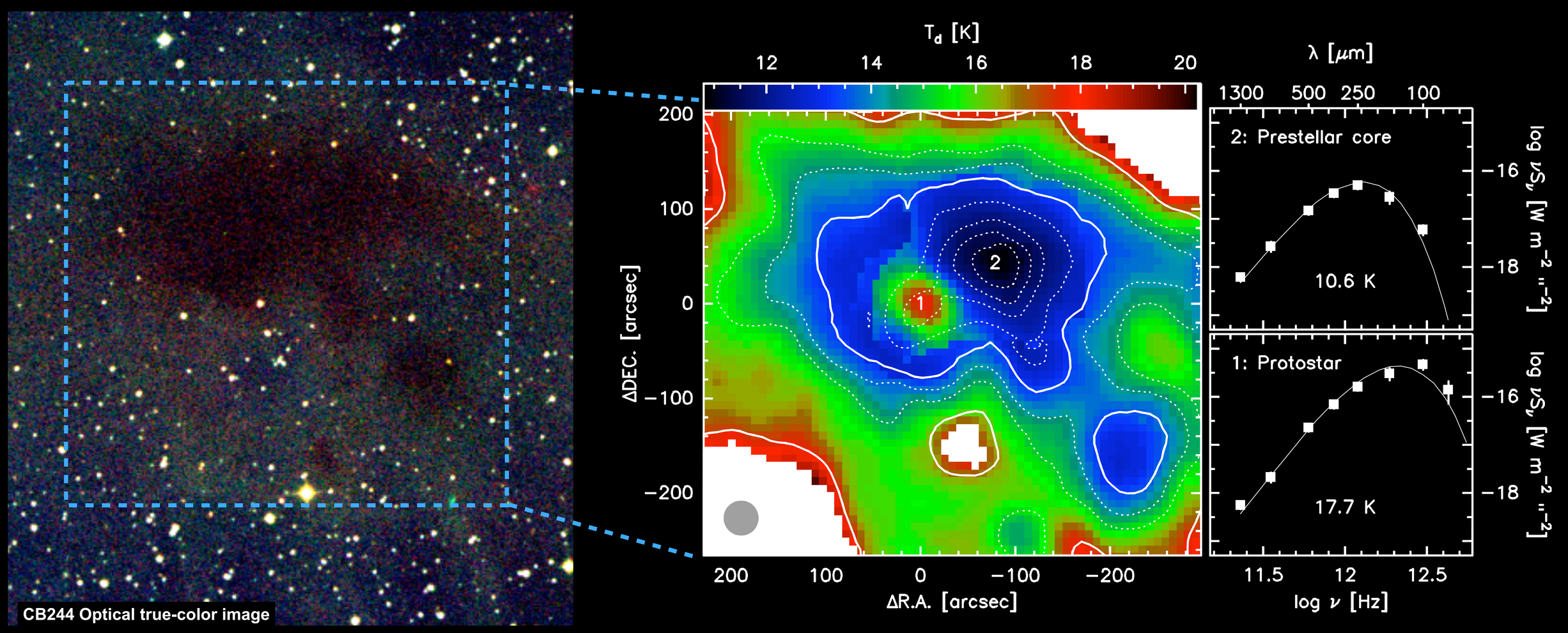
The EPoS sample consists of PACS and SPIRE imaging-mode observations of sites of both high- and low-mass star formation. The low-mass portion of the sample is the focus of the work presented here. Our programme will observe low-mass sources to infer the physical conditions, namely the core dust temperature and density structure, in star-forming Bok Globules. The Herschel observations cover the peak of the cold dust emission for our sources. These targets were selected to be: 1. nearby (d < 600 pc), 2. isolated, 3. of an angular size matching the PACS maps (7' x 7'), 4. well-characterized in terms of morphology and evolutionary stage, and 5. representative of the three major evolutionary stages in cores: (a) prestellar cores, (b) Class 0 protostellar cores (the youngest protostellar phase), and (c) Class I embedded protostars with a significant envelope.
The SDP observations of the EPoS globules consist of objects CB244 and CB230.





CB244 is an isolated globule at a distance of 200 pc, with an extent of 6', or about 0.5 pc. CB244 contains two submm peaks, a Class 0 protostar and a core without an embeded source which is likely to be prestellar in nature. The two sources are separated by 90 arcsec, and are thus well resolved throughout the PACS and SPIRE bands. The second source, CB230, is located at a distance of 400 pc, has an extent of about 3 arcmin, or 0.3 pc, and contains an unresolved Class I/II protostellar binary. We use Herschel imaging to construct spatially resolved spectral energy distributions of CB244 that cover both sides of the peak of the SED.

These data allow us to measure the dust temperature profiles, and hence the density profiles and mass distribution, with an unprecedented accuracy. They also reveal the role of external heating and shielding by the envelopes in the energy balance of such cores.



Right: Dust temperature (color) and Hydrogen column density (white contours) in CB 244. The line-of-sight averaged mean dust temperature has been derived pixel by pixel from modified black-body SED fits to homogeneously beam-convolved emission maps from Herschel PACS and SPIRE, Spitzer MIPS70, and ground-based submm dust continuum maps at 0.85 and 1.2mm, and a NIR extinction map. Column density contours are 0.3, 0.5, 1 (thick), 2, 3.5, 5, 7, and 10×10^{22} (thick) H/cm^2. SEDs and the respective grey-body fits are shown for at the positions of the Class 0 protostar (1) and the prestellar core (2). Integration of the column density map results in the following total Hydrogen masses: Globule: $M_H = 15\pm5\ M_{sun}$; Protostellar core: $M_H = 1.6\pm0.1\ M_{sun}$; Prestellar core: $M_H = 5\pm2\ M_{sun}$.