# Differential Column Density in Super-Resolution in Taurus

Alexander Howard[1], Kenneth Marsh[1], Matt Griffin[1], Anthony Whitworth[1], Oliver Lomax[1], Seamus Clarke[2]

*Alexander.Howard@astro.cf.ac.uk*

[1] Cardiff University, Cardiff, UK  [2] Universität zu Köln, Köln, DE

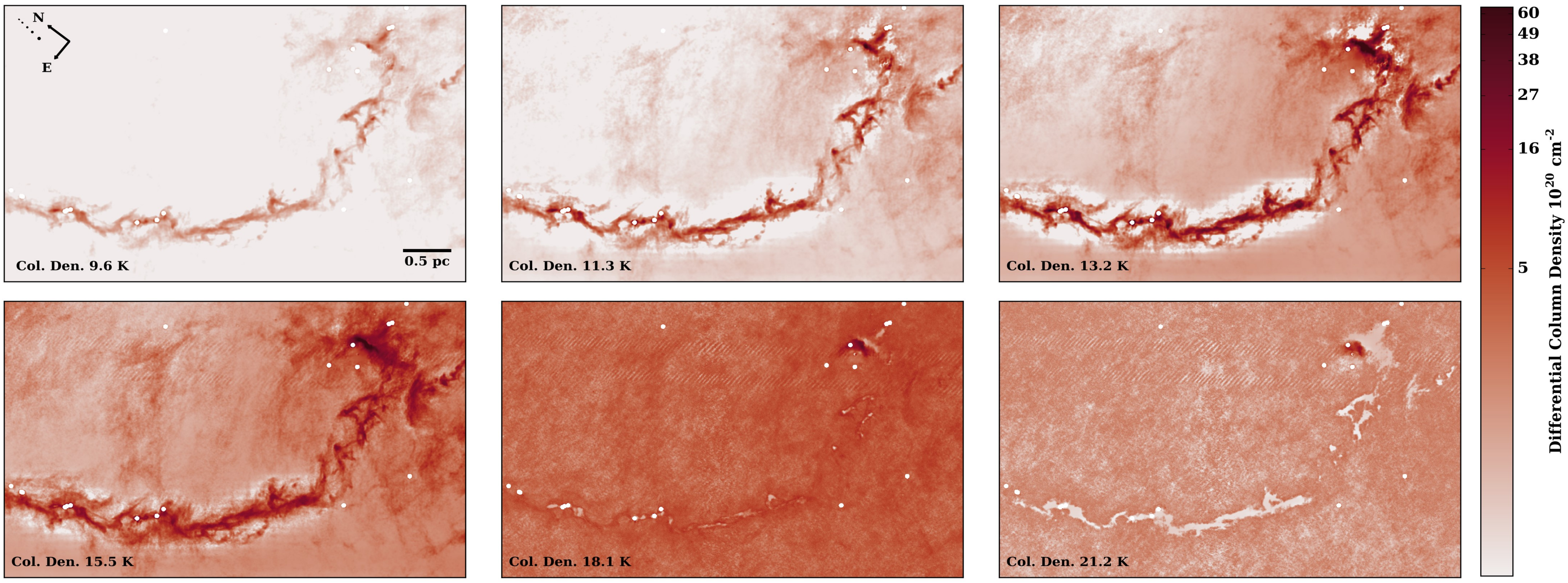


Figure 1. Differential column density slices from a PPMAP Hypercube output of Taurus L1495 at 6" resolution. The slices clearly show cold dust residing in the filament spine, with a hotter diffuse medium and areas of local external heating.

In contrast to the Modified Black Body (MBB) procedure, PPMAP (Marsh et al. 2015) produces maps at much finer resolution, giving the amount of dust in different bins of temperature (T) and different bins of emissivity index $\beta$.

Figure 1 displays PPMAP differential column density slices of L1495, at 6" resolution, produced from Herschel observations. Low temperature slices pick out the dense filament spine, while mid temperatures highlight dust in the outer sheath and diffuse medium. Above 20 K, V892 Tau can be seen heating large quantities of dust.

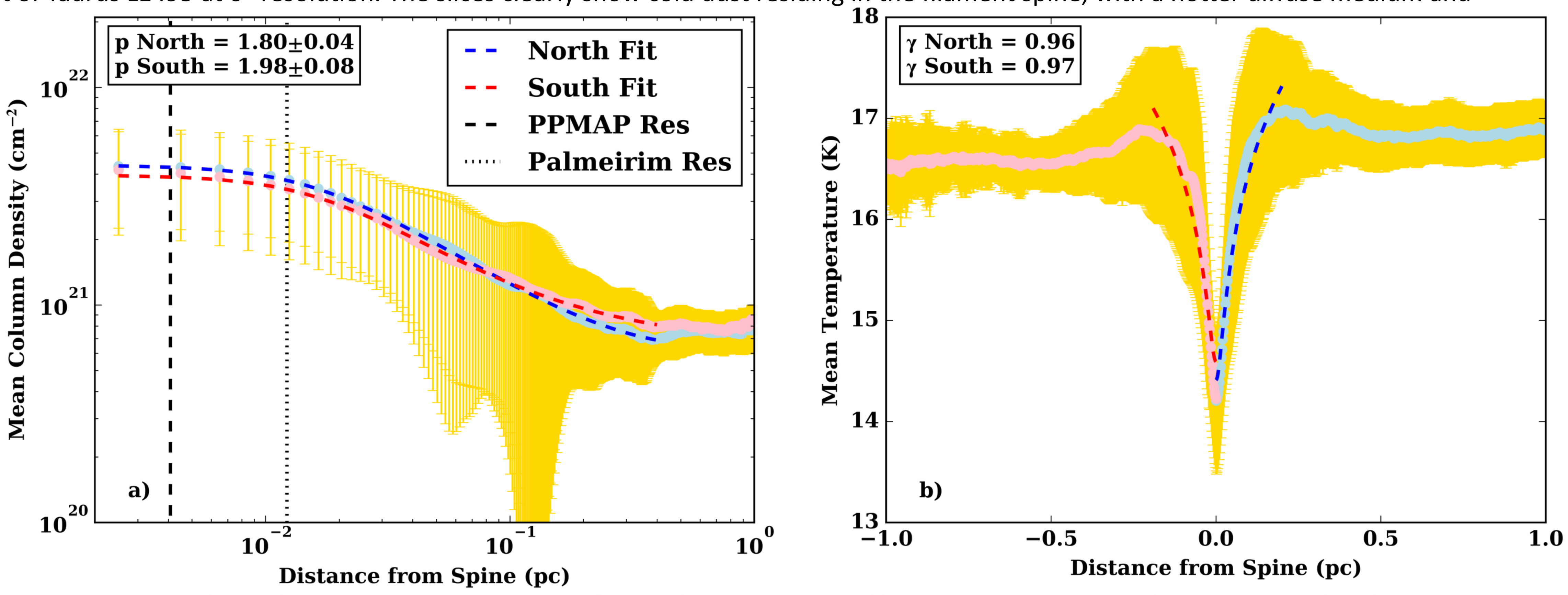


Figure 2. Mean column density and temperature profiles with distance from filament spine. Plummer-like and power law fits were determined by the same method given in Palmeirim, et al., 2013.

Figure 2 shows radial profiles of (a) mean column-density and (b) mean temperature. The northern and southern sides of the filament are fit independently. The resolution of PPMAP is a factor 6 better than traditional MBB fitters, and a factor 3 better than Palmeirim et al., 2013. In (a), the model is Plummer-like, with a radial density exponent $\boldsymbol{p}$. The central column density is half that of a traditional MBB fit, and tests reveal that this is due to MBB (i) underestimating the contribution from warmer than average dust, and (ii) not allowing beta to vary. Panel (b) fits a power law to the temperature profile, with the form $\boldsymbol{T} \propto \boldsymbol{\rho}(\boldsymbol{r})^{\boldsymbol{\gamma}-\boldsymbol{1}}$.

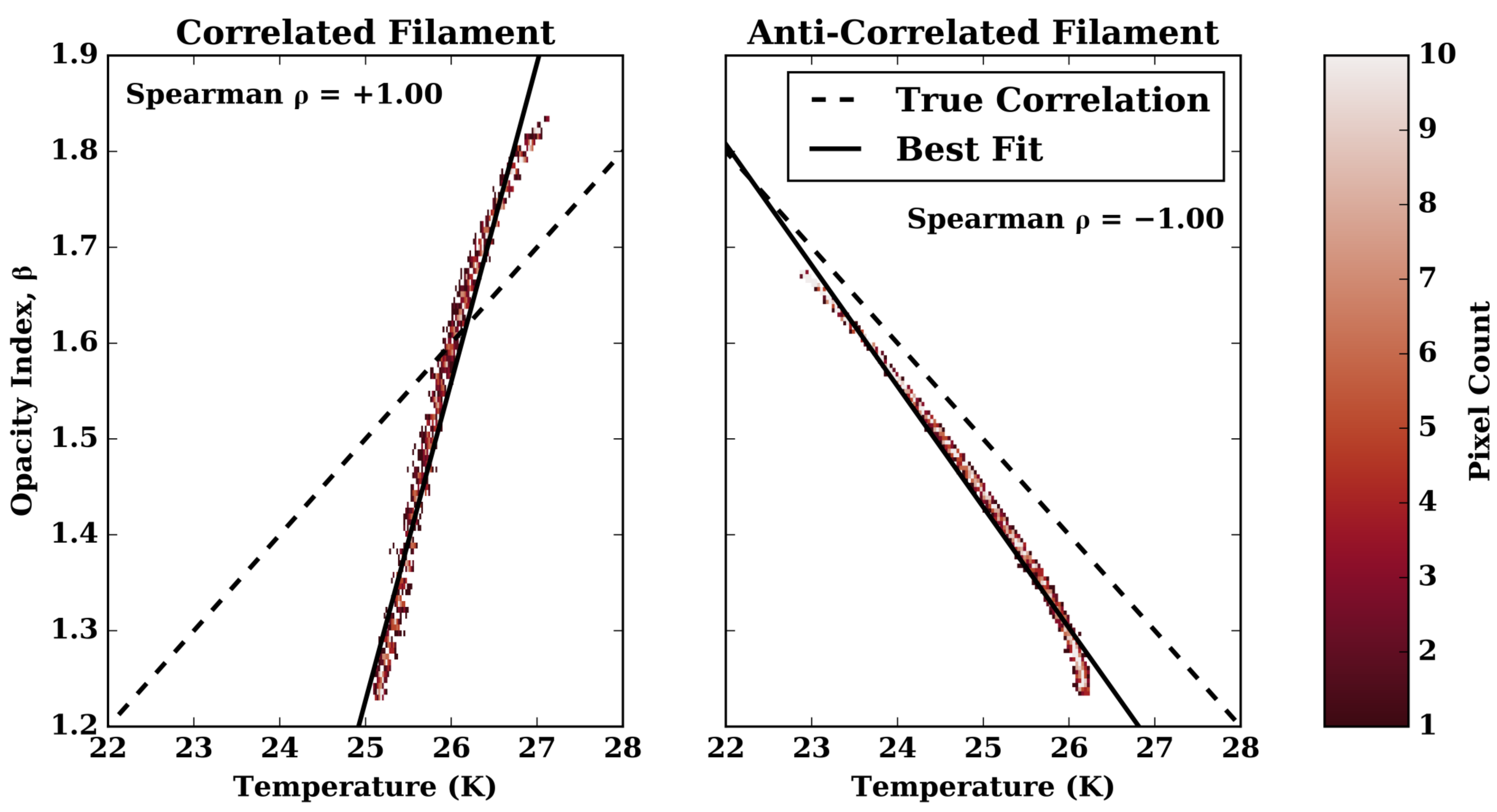


Figure 3. 2D histograms of PPMAP mean temperature and $\beta$ for two synthetic filaments with correlated and anti-correlated radial profiles.

Figure 4 indicates a positive spatial correlation between the mean temperature and mean $\beta$ maps. As this is counter to the intrinsic anticorrelation for Herschel wavebands found in MBB fitting, tests were conducted to detect potential bias in PPMAP. Two radially symmetric filaments were created, with correlated and anticorrelated linear temperature and $\beta$ radial profiles respectively. Herschel-like observations were then produced for each filament.

Figure 3 displays the 2D histograms of the test filaments' mean temperature and mean $\beta$ maps. PPMAP recovers strong linear trends, and correctly identifies correlated and anticorrelated profiles. Therefore, it is unlikely that the apparent correlation in Figure 4 is due to an intrinsic bias. In the near future, longer wavelength SCUBA-2 observations will be added, to better constrain $\beta$.

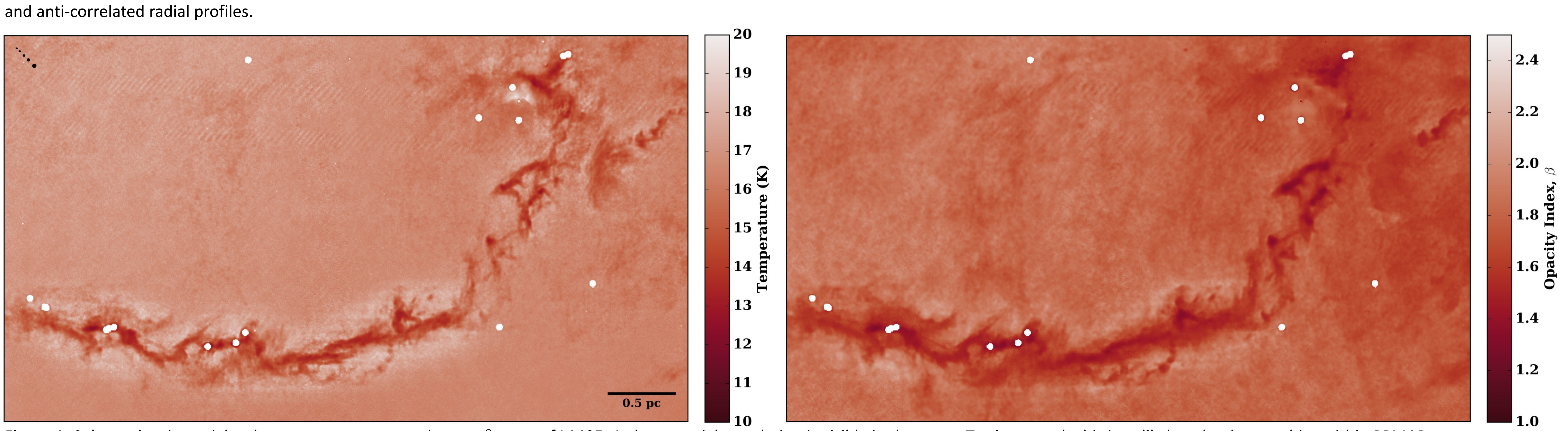


Figure 4. Column density weighted mean temperature and mean $\beta$ maps of L1495. A clear spatial correlation is visible in the maps. Testing reveals this is unlikely to be due to a bias within PPMAP.

• K. Marsh, A. Whitworth, and O. Lomax, MNRAS V. 454 , I. 4, 2015 • P. Palmeirim, Ph. André et al., A&A V. 550, 2013