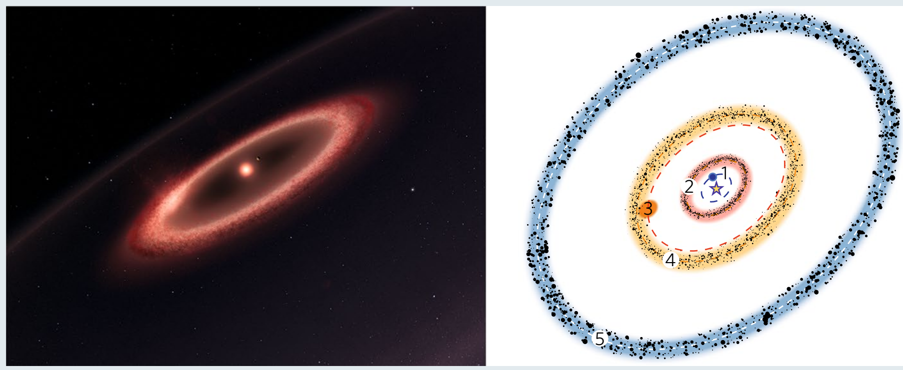
EXOPLANETS

Kuiper belt analogue around Proxima Centauri

Our nearest star, Proxima Centauri — already known to host a (potentially terrestrial) planet — may also be ringed by one and possibly two dusty circumstellar belts (see an artist's impression in the left panel). The brightest belt (numbered 4 in the right panel), which appears as an unresolved disk in the Atacama Compact Array (ACA) 1.3 mm-wavelength image presented by Guillem Anglada et al. (*Astrophys. J. Lett.*, in the press; preprint at https://arxiv.org/abs/1711.00578), lies at a distance of 1–4 au from the star, and there is a hint of a more distant belt at ~30 au (numbered 5). The inner belt was also detected by 41 telescopes of the main ALMA array, but again, not resolved.



Credit: ESO/M. Kornmesser (left); IOP (right)

Comparing the flux densities for the inner unresolved disk obtained with each array (with their differing resolutions) and with the star's expected thermal emission, it is evident that ~75% of the emission does not come from the star itself. Instead, the implication drawn by the authors is that the excess emission arises from circumstellar dust. Empirical relations for the dust temperature and the mass of ~millimetre-sized grains contained in the inner belt (at radii in the range 1–4 au) give ~40 K and 10^{-6} $M_{\oplus}$. Extrapolating to a fuller distribution of grain sizes gives a total dust mass of 0.01 $M_{\oplus}$ in the inner belt.

When adjusted for the lower luminosity of Proxima Centauri compared to our Sun, the inner dust belt is analogous in distance to our Kuiper belt, and the dust mass and temperature are remarkably similar. The dust belts are presumably composed of dust grains and small planetesimals that are remnants of a planet-formation process, or secondary products from the collision of large, failed planetesimals, and thereby continually replenished.

The observational data show extremely tentative evidence for other features of the system. A marginal elongation of the central source along a certain axis, with a similarly marginal excess of emission, might indicate a warm (~90 K) dust component close to the star (numbered 2). An emission peak corresponding to an outer dust belt at ~30 au only appears in the ACA data after azimuthally averaging over concentric elliptical annuli centred on the star. A third tantalizing feature is the marginal detection in the ALMA data of a compact source at 1.6 au (numbered 3). It is not clear what this source is, or whether it is real. Possibilities include a background galaxy, a substellar object, or even a small dust cloud from a collision between planetesimals. The authors' most exciting scenario for the source is the ring system around a Saturn-like giant planet. More sensitive observations will refine these options, and also further constrain the inclination of the dust belt(s). This information will in turn allow a better estimate of the mass of Proxima Centauri b (numbered 1). ❐

Paul Woods

Published online: 29 November 2017
https://doi.org/10.1038/s41550-017-0344-5