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## The Spatially Resolved Dust-to-Metals Ratio in M101

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The dust-to-metals ratio provides insights into the life cycle of dust. We measure the dust-to-metals ratio in M101, a nearby galaxy with a radial metallicity gradient spanning  $\sim 1$  dex. We fit the dust spectral energy distribution (SED) from 100 to 500  $\mu m$  with five variants of the modified blackbody (MBB) dust emission model (free  $\beta$ , fixed  $\beta$ , broken emissivity, warm dust component, and a power-law radiation field distribution). The broken emissivity method performs the best among them, showing small residuals, reasonable  $\tilde{\chi}^2$  distribution, a temperature gradient decreasing with radius and no violation of the upper bounds on available metals. We show that the dust-to-metals ratio is not constant in M101, but decreases as a function of radius, leading to a lower fraction of the heavy elements being trapped in dust at low metallicity. We show that the dust-to-gas ratio (DGR) is proportional to  $Z^{1.71}$ . Alternatively, we could instead explain the DGR gradient as an increase in emissivity as dust grains coagulate. If we assume the Draine et al. 2014 dust-to-metals relation, the opacity constant  $\kappa_{160}$  would increase at most by a factor of two, which is similar to what Planck Collaboration et al. 2014 found.

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Yes

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