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Bayesian inference of three-dimensional gas maps: Galactic CO

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The three-dimensional distribution of both atomic and molecular gas in the Galaxy is a crucial modelling input, both for the generation of diffuse emission in gamma-rays and the transport of cosmic rays. Here, we present new 3D maps of molecular hydrogen based on the Dame et al. (2001) CO survey compilation. We consider the deprojection as a Bayesian variational inference problem. The posterior distribution of the gas densities allows us to estimate both the mean and uncertainty of the reconstructed density. Unlike most of the previous attempts, we take into account the correlations of gas on a variety of scales which allows curing some of the well-known pathologies, like fingers-of-god effects. Both gas flow models that we adopt incorporate a Galactic bar which induces radial motions in the inner few kiloparsecs and thus offers spectral resolution towards the Galactic centre. We compare our gas maps with those of earlier studies and characterise their statistical properties, e.g. the radial profile of the average surface mass density. We briefly comment on an ongoing deprojection of atomic hydrogen.

Keywords

diffuse emission; gamma-rays; ISM; molecular gas; statistical methods

Collaboration

other Collaboration

Subcategory

Theoretical Results

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