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Modeling the neutral gas heating in low metallicity galaxies

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Heating of the neutral interstellar medium is known to partly regulate the star formation in galaxies over long time scales and large spatial scales.
While the neutral gas heating is dominated by the photoelectric effect on small dust grains around Milky Way metallicity, the lower dust-to-gas mass ratio together with the higher occurence and luminosity of X-ray sources in metal-poor galaxies suggest that other heating mechanisms may contribute.
We will present a modeling study of the Dwarf Galaxy Survey, which comprises star-forming galaxies down to metallicities well below 1/10 solar metallicity, observed spectroscopically in the mid-IR and far-IR.

We use a photoionization and photodissociation grid to link the ISM signatures with specific heating mechanisms including the photoelectric effect, ionization by cosmic rays and photoionization by UV and X-ray photons.
Specifically, we use a combination of 1D models parametrized as statistical distributions within a Bayesian framework.
Our results confirm for the first time that the photoelectric effect heating becomes negligible below 1/10 metallicity and that X-rays provide significant heating, with an inferred X-ray luminosity that is in good agreement with direct observations.
The method offers an interesting prospective not only to recover the X-ray source nature and impact in low metallicity galaxies, but also to better understand the heating mechanisms and, more generally the star-formation properties, of galaxies in the early Universe.

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