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Symbolic regression on chemical network for hydrodynamic simulations

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The astrophysical uncertainty in line intensity mapping remains an obstacle to overcome. One of the promising solutions is to generate line intensity maps from hydrodynamic simulations (HD sims) with varied astrophysical properties. Running chemical network (CN) for gas particles in HD sims provides a realistic way to link the astrophysical properties with line luminosities. Given the gas properties, the CN iterates the thermal, chemical and radiative equilibrium equations until it converges, and then assign the luminosity of lines, such as [C II], CO, etc., based on the chemical abundance. However, running the CN is computationally demanding, while it does not explicitly show the connection between gas properties and line luminosities. In this work, we apply the symbolic regression on gas particles spanning a large parametric space. The obtained analytical expression helps us with not only speeding up generating of luminosity, but understanding the physics from astrophysical parameters to line luminosities.

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