Revisiting CH^+ Line Profiles in High-redshift Dusty Star-forming Galaxies with ALMA Cycle 2 and 4 Data

○Hayatsu Natsuki H.[1] Andreani Paola[2] Zeewan Martin[2] Falgarone Edith[3] Inoue Akio[1] (1.Waseda University 2.European Southern Observatory (ESO) 3.École Normale Supérieure (ENS))

CH^+ (835.137 GHz; 358.97 μm for the J = 1–0 transition) is a unique tracer of short-timescale star formation activity. In high-redshift starburst galaxies, CH^+ absorption features embedded within broad emission-line profiles have been interpreted as evidence for dense shock waves powered by hot galactic winds interacting with highly turbulent reservoirs of cool molecular gas.

We revisit the CH^+ emission and absorption properties of representative high-redshift dusty star-forming galaxies using ALMA Cycle 2 observations. By applying independent self-calibration and imaging strategies, we assess the robustness of previously reported spectral features. While the absorption components are consistently recovered across different data products, some reported emission features are not reproduced. We find that these apparent emission signatures arise from the combination of a non-uniform spectral setup and independent flux self-calibration applied to individual spectral windows, which can artificially enhance the continuum level around the absorption feature.

Our results indicate that the reported emission component is not robust, whereas the absorption component remains secure. The classical interpretation in which CH^+ traces turbulent molecular reservoirs therefore remains consistent with the observations. This study highlights the importance of spectral-window configurations and self-calibration strategies when analyzing broad absorption features in ALMA data. We also present a combined analysis of ALMA Cycle 2 and Cycle 4 observations and discuss the implications for future CH^+ studies of high-redshift galaxies.