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Systematic difference in velocity dispersion of ionized and molecular gas: Implications and the need for an R=10k IFU spectrograph

I will report on a recent paper in which we compare the velocity dispersions of ionized gas to that of molecular gas across a range of SFR, gas fraction and redshift. We find a systematic offset such that the ionized gas is ~2.5x larger than molecular gas. This scale factor seems to not depend on SFR and is much too large to be explained by traditional descriptions of thermal broadening. The ionized gas velocity dispersion in galaxies at z>0.5 is widely interpreted an indicator of turbulence in galaxies. The observed decrease in velocity dispersion from z=1 to z=0 is frequently interpreted as a fundamental decrease in turbulence across the same epoch, and this observation has thus driven models of galaxy evolution. If the ionized gas velocity dispersion is driven by mechanisms other than turbulence, then this has significant implications for interpretations of a basic observable representing thousands of hours of previous VLT observations. High spectral resolution will allow us to decompose the ionized gas emission line for detailed study of this offset. I will discuss how the R=10k MAVIS spectrograph is ideally suited to make systematic studies of the ionized gas emission lines in star forming galaxies, and thus provide for a true comparison to models of galaxy evolution.

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