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THERMAL STRUCTURE OF MIXING LAYERS IN BIPOLAR OUTFLOWS

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ABSTRACT

Assuming that molecular outflows from young low-mass stars are driven by fast neutral atomic winds, we further explore the possibility that winds interact with the ambient cloud through entrainment of molecular material.

We model the entrainment region as a mixing layer along the walls of a cavity within the cloud itself. We make use of the 21 cm HI spectral profiles observed in L1551 to specify a priori the overall geometry of the flow and the amount of entrainment at each point. Assuming momentum conservation in the layer, we then determine –in a single parcel approximation– the radial temperature profile of the mixing layer.

We find that, with a reasonable choice of assumptions, the temperature in these regions is 3000–5000 K. This results from heating due to the dissipation of wind kinetic energy as it decelerates outward due to mass entrainment, and from cooling by roto-vibrational emission of molecular hydrogen. We find in fact that, because of the low density, short crossing time, and replenishment from the cloud, the H_2 is not dissociated and acts as the main coolant in the layer.

In the case of L1551 the H_2 emission from the mixing layer, e.g. in the $v = 1 - 0$ $S(1)$ line, should be spread over most of the CO lobes and within the detection limits of current (arcmin resolution) near-infrared spectrographs.

Key words: **ISM: JETS AND OUTFLOWS — STARS: FORMATION**

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