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Hot CO in DR21

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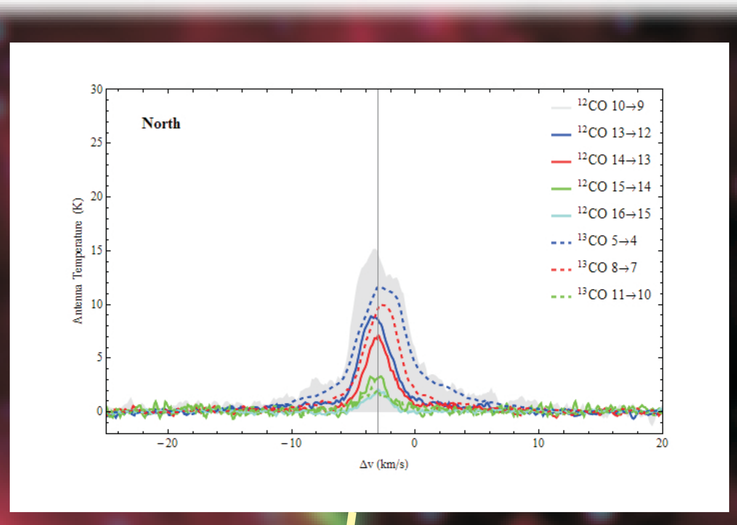
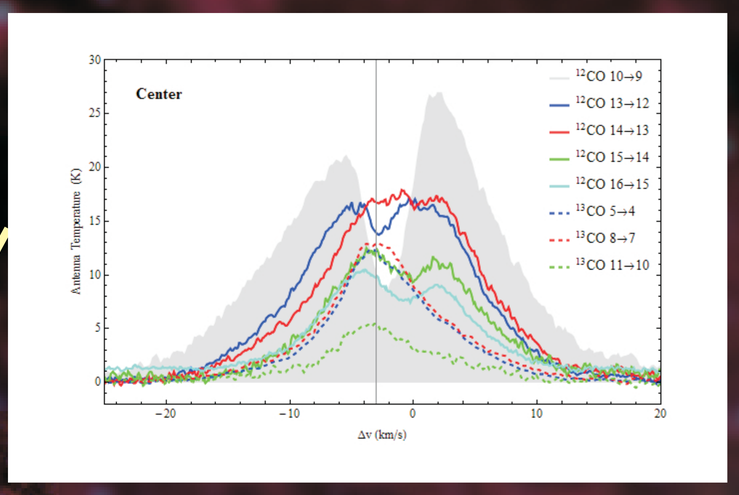
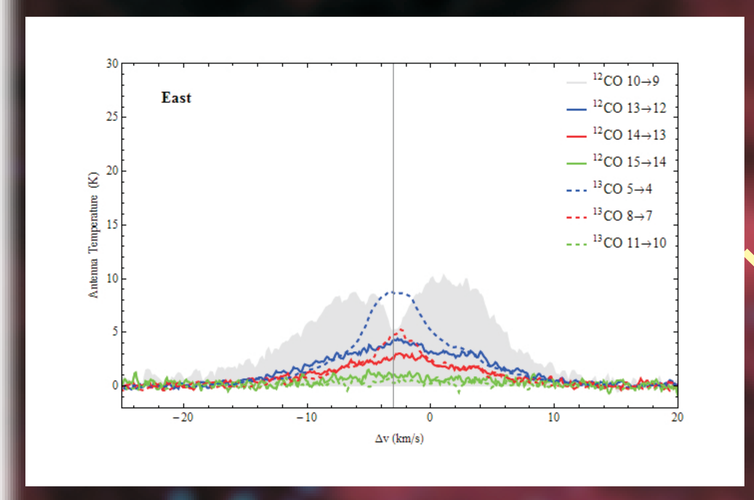
Overview and Motivation

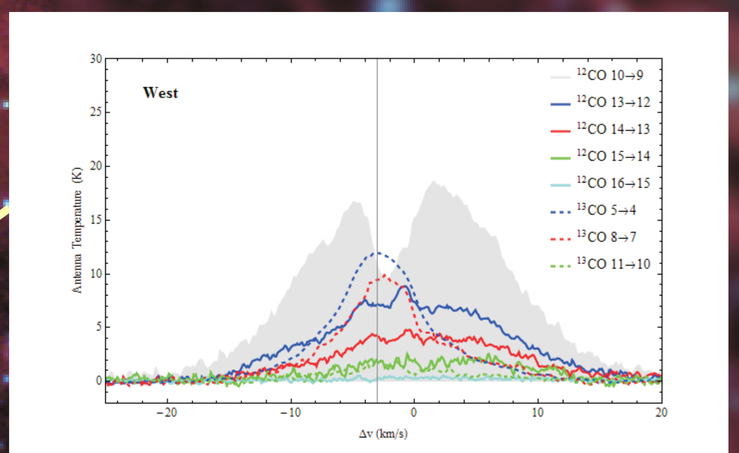
The massive star forming region DR21 C shows a prominent bipolar outflow visible in 2 micron emission of vibrationally excited H2, tracing hot, shocked gas. However, a large fraction of the molecular gas is hardly affected by the shock at all (Ossenkopf et al. 2010).

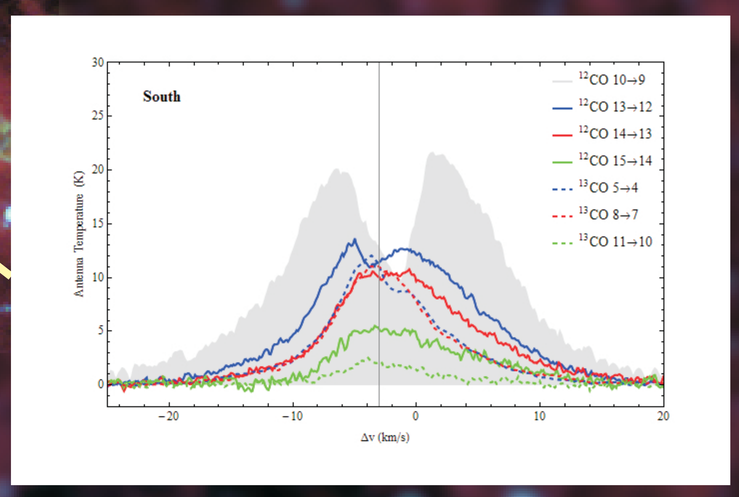
To investigate the question whether any of the CO gas is accelerated by the shocks and to understand how shock/outflows and UV radiation from the embedded OB cluster contributes to the excitation of the surrounding material, we observed Herschel/HIFI strip maps of very high-J ^{12}CO and ^{13}CO lines (up to J=16-15) parallel and perpendicular to the outflow.









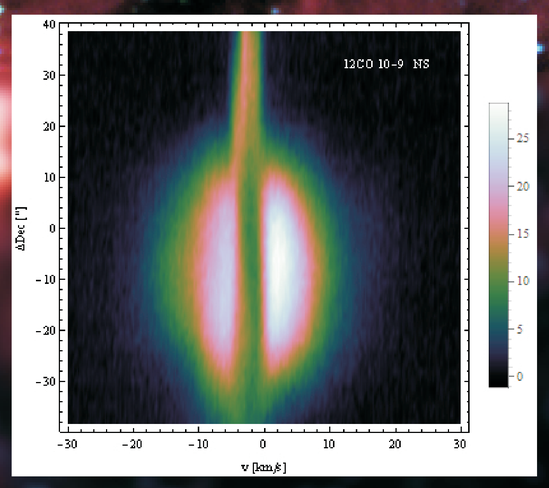


Hot CO

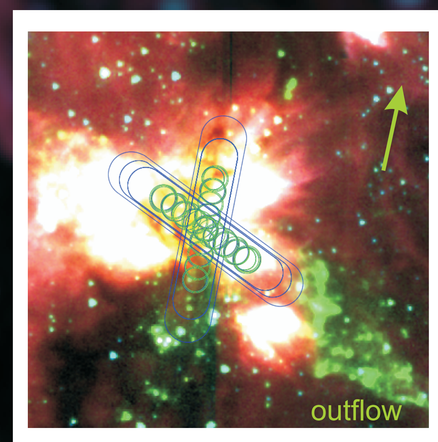
We show the observed high-J CO transitions for the selected five positions along and perpendicular to the prominent bipolar outflow visible in the Spitzer/IRAC composite image (3.6 μm (blue), 4.5 μm (green), and 8.0 μm (red)) and show an overlay of the observed high-J CO transitions observed there.

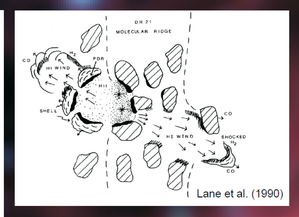
Along the outflow we observe very broad lines with strong self-absorption dips in the most intense lines. This has already been observed in low-J CO lines and is commonly interpreted as large-scale infall. North of the outflow, the line widths are much narrower and the line excitation is much weaker indicating a dominance of PDR over shock excitation.

The very broad and strong lines south of the outflow (see PV diagram of CO 10-9 on the right) indicate specifically highly shocked gas. The observations of these high-J CO lines are thus well suited to disentangle the very complex outflow emission pattern detected in the CO 2-1 line (Schneider et al. 2010), and to determine the excitation conditions of the various gas phases.



Position-Velocity diagram for ^{12}CO 10-9 along a N-S strip. The switch from very narrow, low excited lines to the broad and strongly self-absorbed line profile is clearly visible.





The observed HIFI strips parallel and perpendicular to the outflow. The green arrow indicates the N-S direction.

References: Garden et al., 1986; Davis et al., 2007; Lane et al. (1990); Jakob et al. (2007); Schneider et al., (2010); Ossenkopf et al. 2010;

Observations: OT1_mrllig_1, "Hot CO in the Massive Star Forming Region DR21", 11.6 hrs total time, PI: M. Röllig

OBS-ID: 1342245386, 1342256420, 1342259721, 1342259722, 1342259750, 1342256307, 1342259726, 1342256305, 1342256306, 1342255769, 1342255770, 1342255772, 1342255773, 1342256469, 1342256463, 1342256464, 1342256465