The dynamics and star-forming potential of the massive Galactic centre cloud G0.253+0.016

Katharine G. Johnston[1], Henrik Beuther[1], Hendrik Linz[1], Anika Schmiedeke[2], Sarah E. Ragan[1] and Thomas Henning[1]

1. MPIA, Heidelberg, Germany
2. I. Physikalisches Institut der Universitaet zu Koeln, Collogne, Germany
E-mail of submitting author: johnston@mpia.de

The massive infrared dark cloud G0.253+0.016 projected 45pc from the Galactic centre contains ~10^5 $M_\odot$ of dense gas whilst being mostly devoid of observed star-formation tracers. To scrutinise the physical properties, dynamics and structure of this cloud with reference to its star-forming potential, we have carried out a concerted SMA and IRAM 30m study of this cloud in dust continuum, CO isotopologues, shock tracing molecules, as well as H_2CO to trace the gas temperature. We detect and characterise the dust cores within G0.253+0.016 at ~1.3mm and find that the kinetic temperature of the gas is >320K on size-scales of ~0.15pc. Analysis of the position-velocity diagrams of our observed lines show broad linewidths and strong shock emission in the south of the cloud, indicating that G0.253+0.016 is colliding with another cloud at v_{LSR}~70km/s. We confirm via an analysis of the observed dynamics in the CMZ that it is an elongated structure, orientated with Sgr B2 closer to the Sun, however our results suggest that the actual geometry may be more complex than an elliptical ring. We find that the column density PDF of G0.253+0.016 is log-normal with no discernible power-law tail, consistent with little star formation, and that its width can be explained in the framework of theory predicting the density structure of clouds created by supersonic, magnetised turbulence. We also present the delta-variance spectrum of this region, and show it is consistent with that expected for clouds with no star formation. Using G0.253+0.016 as a test-bed of the conditions required for star formation in a different physical environment to that of nearby clouds, we also conclude that there is not one column density threshold for star formation, but instead this value is dependant on the local physical conditions.