WHAT MOLECULAR LINES CAN TELL ABOUT EARLY STAGES OF MASSIVE STARS

TATIANA VASYUNINA, ERIC HERBST, *Ohio State University, 191 W. Woodruff Ave.,43210, Columbus, OH, USA*; HENDRIK LINZ, THOMAS HENNING, HENRIK BEUTHER, *Max Planck Institute for Astronomy (MPIA), Königstuhl 17, D-69117 Heidelberg, Germany*; IGOR ZINCHENKO, *Institute of Applied Physics of the Russian Academy of Sciences, Ulyanova 46, 603950 Nizhny Novgorod, Russia*; MAXIM VORONKOV, *Australia Telescope National Facility, CSIRO Astronomy and Space Science, PO Box 76, Epping, NSW 1710, Australia*.

Here we present our molecular line investigation of the southern infrared dark clouds (IRDCs). We performed observations of 13 molecular species using the 22-m Mopra radio telescope. In our survey we included in general species which are good tracers of cold and dense gas. Some of them trace the more quiescent gas (e.g. HNC, N_2H^+), while others are sensitive to more dynamical processes (HCN, HCO^+). We detect SiO emission in some clouds and complicated shapes of the HCO^+ emission line profile in all IRDCs, which indicates infall and outflow motions and the beginning of starformation activity, at least in some parts of the IRDCs. Using H_2 column densities from our previous investigation, we estimated molecular abundances for all species. We uncovered a tendency for IRDCs to have molecular abundances similar to those in low-mass pre-stellar cores. This similarity may indicate similar chemical composition at the earliest stages of low- and high-mass stars and their close evolutionary status. However, for the N_2H^+ and HCO^+ species, there is a tendency for higher mean abundances in IRDCs compared with low- mass cores. To find a reason of such behavior, we use chemical models including gas-phase reactions and accretion and desorption onto/from grains. Chemical modeling allows us to study chemical evolution at the early stages of massive stars in more detail and reconstruct the physical conditions and evolutionary status of IRDCs.