CONTROL ID: 2258315
TITLE: Water Emission in Supernova Remnants Observed with Herschel
ABSTRACT BODY:
Abstract Body: We present Herschel HIFI, PACS and SPIRE observations towards the three molecular cloud interacting supernova remnants. Herschel spectra revealed rich molecular lines of high-J and low-J carbon monoxide, water, hydroxyl and a few atomic lines of oxygen and carbon. Water lines are detected from G349.7+0.2 and CTB37A and not detected from G357.7+0.3. A very broad emission line was detected from G349.7+0.2 at 557 GHz from the ground state transition 1_10-1_01 of ortho-water. This water line can be separated into three velocity components with widths of 144, 27 and 4 km/s. The 144 km/s component is one of the broadest molecular lines detected in the ISM. This shows that water lines are important tools to probe shock dynamics. PACS observations revealed 3 additional ortho-water lines, as well as numerous high-J carbon monoxide (CO) lines (from upper J=4 to J=36). A J-shock model with a density of 10,000 per cubic cm and a shock velocity of 80 km/s reproduces the observed CO brightnesses and adequately reproduces the water. The detection of very broad water line is direct evidence of presence of high velocity J-shock which is consistent with the model derived from CO brightnesses. Two far-infrared fine-structure lines, [O I] at 145 micron and [C II] line at 157 micron, are also consistent with the high velocity J-shock model. The broad water line with 144 km/s is the first direct evidence of short-lived molecules that have not been destroyed in high velocity J-shocks. We will also present the abundance and excitation of oxygen−bearing molecules and oxygen chemistry in dense molecular gas shocked by powerful supernova blast waves, and revisit the cooling budget by molecules, and compare with those in other objects such as protostars, star-forming regions, planets, Orion and Sgr B2. Finally, we will discuss formation or dissociation of various molecules under the effect of high energy emission, precursors, or dust processing in shocks.
CONTACT (NAME ONLY): Jeonghee Rho
CONTACT (E-MAIL ONLY): jrho@seti.org
AUTHORS/INSTITUTIONS: J. Rho, SETI Institute, Mountain View, California, UNITED STATES|
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