CONTROL ID: 2256560

TITLE: Water vapor emission in ultra-luminous infrared galaxies at z~2-4

ABSTRACT BODY:

Abstract Body: *Herschel* observations of local Ultra-Luminous InfraRed Galaxies (ULIRGs) have revealed a rich spectrum of submillimeter H_2O rotational emission lines up to upper level energies of $E_{u/k}$ =642 K. And most local ULIRGs emit such luminous high-excitation H_2O lines. From the analysis of the excitation of these H_2O emission, they are likely probe the local IR radiation field in their dense galactic cores several 100 pc in diameter, but the lower levels ($E_{u/k}$ ~ 100-150 K) may also well be excited by collisions and shocks as in Milky Way hot cores. Strong H_2O lines provide therefore a unique diagnostic for a totally different regime than the CO usual lines. We have detected H_2O (five of them have both J=2 and J=3) in 16 high-z (z~2-4) lensed ULIRGs discovered by *H*-ATLAS survey using PdBI. As in local ULIRGs, the intensity of the high-z H_2O lines are about half that of high-J CO lines at similar frequencies. The CO in some of the sources have similar profile compared with H_2O, indicating similar location and thus physical condition, considering differential lensing. The intrinsic H_2O luminosity (corrected for the magnification factor) increases rapidly with the intrinsic IR luminosity (slightly faster than linearly, $L_{H2O} \sim L_{IR}^{1.2}$. This implies that IR pumping is important for H_2O excitation in these sources. The key role of IR pumping is also confirmed in local ULIRGs such as Mrk 231 and Arp 220 by the strong excitation of J=3 and 4 H_2O lines, such as $3_{21}-3_{12}$ or $4_{22}-4_{13}$, with upper level energy $E_{u/k}$ ~ 300–450 K. But the ratio of J=2 lines ($E_{u/k}$ ~ 100 K) to J=3 and 4 lines varies in high-z ULIRGs, likely reflecting contributions from different excitation processes. Finally, these J=2 H_2O lines may be detected in practically all Herschel strong lenses with the PdBI. ALMA should be able to study H_2O in all Herschel high-z sources (SMGs) even those that are unlensed. However, high resolution study by the telescope like NOEMA and ALMA is still needed for studying the detail spatial distribution of water vapor.

CONTACT (NAME ONLY): Chentao Yang

CONTACT (E-MAIL ONLY): yangcht@pmo.ac.cn

AUTHORS/INSTITUTIONS: C. Yang, Purple Mountain Observatory, Nanjing, CHINA|C. Yang, Institut d'astrophysique de Paris, Paris, FRANCE|

PRESENTATION TYPE: Poster