THE ROTATION TEMPERATURE OF METHANOL IN COMET 103P/HARTLEY 2. Yo-Ling Chuang[1], Yi-Jehng Kuan[1,2], Stefanie N. Milam[3], Steven B. Charnley[3], Iain. M. Coulson[4], [1]National Taiwan Normal University, 88, Sec. 4, Ting-Chou Rd., Taipei 116, Taiwan, ROC (email: ylchuang@ntnu.edu.tw), [2]Institute of Astronomy and Astrophysics, Academia Sinica, 1, Sec. 4, Roosevelt Rd., Taipei 106, Taiwan, ROC, [3]NASA Goddard Space Flight Center, Astrochemistry Laboratory, Code 691.0, 8800 Greenbelt Rd., Greenbelt, MD 20771, USA, [4]Joint Astronomy Center, P.O.Box 1104, Keaau, HI 96749, USA.

Introduction: Considered to be relics from Solar System formation, comets may provide the vital information connecting Solar Nebula and its parent molecular cloud. Study of chemical and physical properties of comets is thus important for our better understanding of the formation of Solar System. In addition, observing organic molecules in comets may provide clues fundamental to our knowledge on the formation of prebiotically important organic molecules in interstellar space, hence, may shed light on the origin of life on the early Earth.

Comet 103P/Hartley 2 was first discovered in 1986 and had gone through apparitions in 1991, 1997, and 2004 with an orbital period of about 6 years, before its latest return in 2010. 2010 was also a special year for Comet 103P/Hartley 2 because of the NASA *EPOXI* comet-flyby mission.

Observations: In support of the *EPOXI* mission, we thus conducted spectral observations of methanol, using the Submillimeter Telescope (SMT) and the Kitt Peak 12 meter telescope (KP12M) of Arizona Radio Observatory, toward Comet Hartley 2 during its perihelion on 2010 October 22 – 24 and 29, and again at *EPOXI* comet encounter on November 04.

Results and Discussions: Our observations reveal apparent temporal variations of CH_3OH outgassing over days; much faster temporal variation on a time scale of hour is also disclosed, as reflected in our data taken on October 24. We found the rotational excitation temperature of CH_3OH rising from ~36 K to 45 K, when Hartley 2 was closing toward the Sun. Moreover, the methanol production rate of Hartley 2 was also the highest, reaching $\sim 4 \times 10^{26}$ molecules per second from the cometary nucleus, at perihelion on October 24. Our cometary study therefore not only uncovers the rapid-variation nature of the CH_3OH outgassing extent from cometary nucleus, but is also essential in providing crucial information on the physical environment of Hartley 2 prior to the *EPOXI* flyby and at the encounter.