THE CARBON-CHAIN DEPLETION OF RECENTLY OBSERVED JUPITER FAMILY COMETS FROM PHOTOMETRY AND SPECTROSCOPY. M. Vander Donckt[1], K. Aravind[2], E. Jehin[1], S. Ganesh[2], S. Hmiddouch[1,3], Y. Moulane[4], Z. Benkhaldoun[3], A. Jabiri[3], Z. D. Sahu[5], T. Sivarani[5], [1]Space sciences, Technologies & Astrophysics Research (STAR) Institute, University of Liège, Liège, Belgium (mathieu.vanderdonckt@uliege.be), [2]Physical Research Laboratory, Navarangpura, Ahmedabad 380009, India, [3]Cadi Ayyad University, Marrakech, Morocco, [4]Physics Department, Leach Science Center, Auburn University, AL 36832, USA, [5]Indian Institute of Astrophysics, Bangalore 560034, India.

Introduction: Comets are remnants from the formation of the Solar System, thought to have kept an almost pristine composition since their formation 4.6 billion years ago. Studying the populations of such pristine bodies is of great interest to understand the evolution of the Solar System from the protoplanetary disk stage to today. Optical photometric and spectroscopic observations of comets give us insights into the composition of their atmosphere content in dust and secondary species (volatiles processed by the solar radiation field). From such observations, [1] found in their survey of 85 comets two main groups based on the chemical composition of the coma: typical and C-chain depleted; the later group showing a clear depletion in C_2 (and often C_3) in relation to OH and CN. This discovery was confirmed by other large surveys [2,3].

The origin of C-chain depleted comets: The majority of C-chain depleted comets discovered so far belongs to the short-period Jupiter Family comets (JFCs) dynamical group (Figure 1), pointing at two possible different formation scenarios that reflect the formation conditions and history evolution of the JFCs ([4] and previous references). In a first scenario, the C-chain depleted JFCs formed in a different region of the protoplanetary disk than other comets. The observed depletion today would be reminiscent of the physico-chemical conditions at the place where the comets originally formed, which would be preserved in the comet nucleus ices. In a second scenario, observed JFCs depletion in C_2 and C_3 volatiles would be due to the repeated proximity to the Sun of short period comets and exhaustion of precursor ices of C-chain volatiles. The later scenario implies a change in the nucleus ices abundances over time. Better characterization of the JFC group C-chain depletion is therefore important to better constrain the (non-)evolution of cometary bodies and give constrains on the Solar System evolution.

Observations: We will present our recent observations of several C-chain depleted comets or potential C-chain depleted comets, such as 4P, 57P, 67P, 73P, 81P, 260P and 398P, from a photometric survey with HB narrow-band filters [5] with the 0.6m TRAPPIST-South (La Silla, Chile) and TRAPPIST-North (Oukaimeden, Moroco) telescopes [6], as well as long-slit spectroscopic observations with the 2.0m Himalayan Chandra Telescope (Mt. Saraswati, India) and the 2.2m at Calar Alto (Spain).

The production rates ratios over different epochs will be compared to the chemical classification by [1]. In addition, we will discuss best practices regarding the dust contribution subtraction in narrow-band gas photometry through comparisons with spectroscopic datasets.

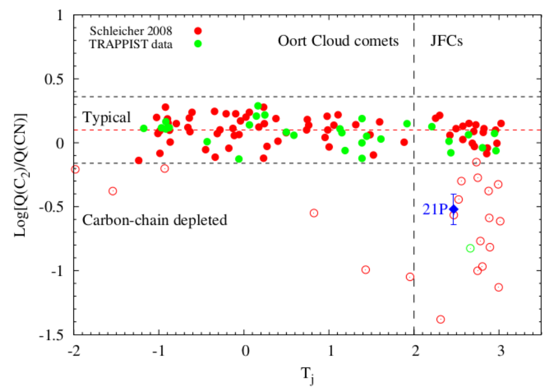

Figure 1: The logarithm of the C_2/CN ratio as a function of the Tisserant invariant parameter with respect to Jupiter for 110 comets from the Schleicher 2008 survey [7] and the TRAPPIST monitoring [4]. Most C-chain depleted comets are part of the JFC group. Taken from [4].

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