502.08 – Study of the Forbidden Oxygen Lines in Comets at Different Heliocentric and Nucleocentric Distances

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Oxygen is an important element in the chemistry of the solar system objects given its abundance and its presence in many molecules including H_2O (~80% of cometary ices). The analysis of oxygen atoms in comets can provide information not only on the comets themselves but also on the solar system. These atoms have been analyzed using the 3 forbidden oxygen lines [OI] observed in emission in the optical region at 5577.339 Å (the green line), 6300.304 Å and 6363.776 Å (the red lines) (Swings, 1962). Our analysis is based on a sample of 12 comets of various origins. The observing material is made of 53 high signal-to-noise spectra obtained with the high-resolution UVES spectrograph at the ESO VLT from 2002 to 2012 (Manfroid et al, 2009). After noticing that the green line is blended with one C2 line, we built synthetic spectra of C2 for each observing circumstances and we subtracted its contribution to the cometary spectra in order to ensure the decontamination of the 5577 Å line. Then, we measured the intensity of the 3 [OI] lines at different heliocentric distances. By comparing the green to red lines ratio (G/R) with the Bhardwaj & Raghuram (2012) effective excitation rates, we found that H_2O is the main parent molecule when the comet is observed at r~1 au. When the comet is located beyond 2.5 au from the Sun, CO_2 also contributes to the production of oxygen. Studying forbidden oxygen lines could be a new way to estimate the abundances of CO_2 in comets, a very difficult task from the ground (Decock et al. 2013). In order to estimate the effect of the quenching on our results, we analyzed the evolution of the G/R ratio at different nucleocentric distances. For nearby comets, we divided the extended 2D spectrum into several zones in order to analyze the oxygen lines as close as possible to the nucleus (down to ~10 km for the closest comets). Their analysis will allow us to study the link of the oxygen lines with the nucleocentric distance. We found a clear variation of the G/R ratio close to the comet nucleus that is in agreement with a contribution from CO_2 as predicted by Raghuram & Bhardwaj (2013).

503 – Origins 1: Solar System Shuffle and Outer Moons

503.01 – On the Behavior of the Galilean Satellites in the Jumping Jupiter Scenario

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The Nice model of the dynamical instability and migration of the giant planets can explain many properties of our present Solar System, and can be used to constrain its early architecture. In the jumping Jupiter version of the Nice model, required from the terrestrial planet constrains, Jupiter is involved in encounters with an ice giant. Here we study the survival of the Galilean satellites in the jumping Jupiter model. This is an important concern because the ice giant encounters, if deep enough, could dynamically interfere with the orbits of the Galilean satellites, and lead to implausible results. The jumping Jupiter models are taken from Nesvorný and Morbidelli 2012 (NM12). Our metodology in this study take into account the effects of the Sun, Jupiter's oblateness and obliquity, as well as the planetary close encounters tracked in NM12 upon the Galilean moons. We considered three instability cases that differed in the number and distribution of ice giant encounters with Jupiter. In each case, we considered 1000 realizations of the Galilean satellite system before the instability, and integrated the dynamical response of satellite orbits to ice giant encounters. We found that in one of the considered cases, where the number of close encounters was relatively small, the Galilean satellite orbits were not significantly disturbed. In the other two, the final orbital eccentricities were [0-0.2], and Callisto's semi-major axis ended within [22-30]Rj, while the other satellites kept their semi-major axis nearly constant. As Callisto's semi-major axis may vary as much, we also hint on the possibility that all four Galilean satellites were originally formed in a Laplace resonance, and Callisto was kicked out of it by encounters. These results: i) show that Galilean satellites are an important constrain on the planetary instability; ii) can check on the possibility to the Galilean system have been formed in a different configuration of seen today. Acknowledgement: FAPESP

503.02 – `Getting down to brass tacks' in the Grand Tack scenario: matching important accretion and timing constraints

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