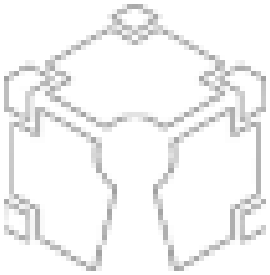

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Formation Flying, an opportunity to enhance microwave cosmology with CubeSats

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CubeSat has become a satellite concept with increasing interest for space research and exploration. Key elements of its success have been standardization, easy design and low cost. However, the constraints of space, weight and power represents practical limitations for the scientific instrumentation that can be accommodated limiting the scientific scope that the CubeSat concept can have. Nevertheless, it is expected to be a very competitive solution for those scientific applications that can be adapted to those constraints.

Recent missions such as CanX-4 & 5 have shown that CubeSats already have the necessary technology to carry out formation flight. Formation flying multiplies the possibilities of performing science of small satellites. This concept is the one used in the future ESA PROBA-3 mission, in which one of the satellites of the formation flight acts as a parasol, hiding the solar disk so that the other can study the solar corona. Although PROBA-3 is not made up of small spacecrafts, other missions with similar concept, like NASA's CANYVAL-X, are based on CubeSat technology to demonstrate how two small satellites in formation can be used as a single large telescope. Finally it is possible to use small satellites in conjunction with a large scientific instrument. The CubeSat would travel as a piggyback next to the main ship and could be deployed once in orbit. A small satellite deployed in this way could be used, for example, as a calibrator for the instruments of the main ship, thus obtaining more precise measurements. Furthermore, the small weight and cost of the CubeSats would allow them to be added to the main mission without having a great impact, and they can be conceived as science enhancements of the main mission without jeopardizing it.
In this talk, we present the possibilities of CubeSat formation flying for scientific research in the context of the Cosmic Microwave Background (CMB) science. We will show how the CubeSat concept can be of interest to accommodate a calibration system in the microwave range that can be used to calibrate CMB instrumentation, based either on the ground and using a LEO for the calibration satellite, or on a space mission operating at L2 and requiring formation flying for the calibration satellite. The possibility of having a calibration satellite for CMB science will provide an unprecedented control of systematic effects that are the limiting factor of the future very sensitive CMB experiments.

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