Solar Orbiters for Imaging Asteroids (S.O.F.I.A.)

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Abstract: With plans to deflect, visit and mine asteroids beginning to become real, the Near-Earth Asteroids (NEOs) detection/characterization phase becomes the leading priority in developing asteroid resources. However, in order to plan mission to NEOs, firstly we need to find the missing population of NEOs and fully characterize it. Our study aims to characterize hundreds of NEOs in less than 5 years using hundreds of interplanetary Cubesats.

S.O.F.I.A. will put 360 Cubesats at a 0.9 AU heliocentric orbit, with a spacing of 0.015 AU. This formation solves the following problems: 1) synodic period problem 2) survey all of 1 AU orbit and 3) since it will observe NEOs at phase 0, optics requirements are minimal. Using the Microfluidic Electrospray Propulsion (MEP) developed in JPL, each of the Cubesats will require maximum 2 years for a trip to station. They will then spend 1 year as NEO Sentinels and on the third year they will start their 1.5 years round trip to their assigned NEOs. Another 3-6 months will be spent in orbit around the NEO gathering data. As soon as they are back in formation, each of the Cubesats will start relaying its data to the nearest Cubesat, until the nearest Cubesat to Earth relays everything back to the ground.

S.O.F.I.A. not only will be able to produce the largest ever database of NEOs but also to fully characterize hundreds of them. The latter can't be achieved from the ground and it is absolutely crucial in planning any future NEO mission. The mission relies in mass production of Cubesats hence not subject to single unit failures both in orbit but also on the ground. In addition mass production translates to lower development cost.