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CubeSAT X-ray Telescope (CubeX) for Elemental Abundance Mapping of Airless Bodies and X-ray Pulsar Navigation (XNAV)

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Abstract

The CubeSAT X-ray Telescope (*CubeX*) is a concept for a 12U planetary X-ray telescope, which utilizes Miniature Wolter-I X-ray optics (MiXO) and a combination of X-ray CMOS and SDD sensors for the focal plane. *CubeX* will map the surface elemental composition of diverse airless bodies using X-ray Fluorescence (XRF), which can help us to understand the formation and evolutionary history of the individual bodies and the workings of the Solar system as a whole. *CubeX* will also conduct a feasibility and performance test of X-ray pulsar timing based deep space navigation (XNAV), which can lower operation costs of space navigation and enable autonomous deep space navigation. The first *CubeX* concept is designed to rideshare to the Moon as a secondary spacecraft on a primary mission that will be inserted into a high-altitude lunar orbit (4000 x 6000 km). High resolution imaging enabled by MiXO in *CubeX* allows flexible observing conditions from relatively stable elliptical polar lunar orbits. *CubeX* will study >8 key regions (~35-140 km) of geological interest on the Moon for a year to produce a high resolution (~0.6-2.3 km) elemental abundance map of each region. The novel focal plane design of *CubeX* also allows us to conduct delta-correction using the Crab pulsar and PSR B1937+21, and evaluate the performance of absolute navigation by sequential observations of several millisecond pulsars during the dark side of the orbits.