

Orbit selection and implications for TianQin

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Abstract. TianQin is a geocentric space-based gravitational-wave observatory mission consisting of three drag-free satellites in a nearly equilateral-triangle formation [1]. The current baseline proposes an orbital radius of $\sim 10^5$ km, and set the orbital plane roughly perpendicular to the ecliptic and face a verification source.

Here we present optimized orbits for TianQin with calculated performance in terms of the variations of arm lengths, relative velocities, breathing angles, point-ahead angles, and detector pointing, as well as residual arm-length imbalance and eclipse duration. The impact of choosing different orbit radii and detector pointings on the stability of the constellation is pointed out. Lastly, we discuss implications of the orbit design on science payloads, spacecraft thermal control, environmental noise reduction, time delay interferometry, and science operations. Possible solutions are mentioned to tackle technical difficulties associated with the geocentric concept.

References

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