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The Firefly (4π) Constellation: Going Above and Beyond in the Heliosphere Exploration

Heliospheric exploration has soared to unprecedented heights in recent decades thanks to innovative space-borne missions, ground-based observatories, and advancements in computing, models, and theory. However, the progress of inner-heliospheric research is hindered by observing limitations, preventing resolving long-standing problems such as understanding the solar dynamo, solar cycle, solar wind acceleration, and the impact of active region magnetic fields on space weather and Earth. These limitations stem from observing a dynamic 3D star from a single vantage point in the ecliptic. Holistic observations, encompassing the Sun and the inner heliosphere with full 4π -steradian coverage, will open new research avenues and bridge knowledge gaps in heliophysics and astrophysics. The Firefly Constellation mission concept aims to enable simultaneous observations of the Sun and inner heliosphere from multiple viewpoints, revolutionizing our understanding of the Sun's interior, solar atmosphere, and the inner heliosphere. The mission includes spacecraft strategically positioned in the ecliptic plane and at high solar latitudes, all equipped with a comprehensive payload including remote sensing and in situ instruments. We provide an overview of the Firefly mission, which is under consideration by the 2024-2033 Decadal Survey for Solar and Space Physics (Heliophysics), and its success could pave the way for groundbreaking discoveries, building upon the achievements of previous NASA missions.

Contribution Type

Theme

Solar Magnetism over Long-Time Scales

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