

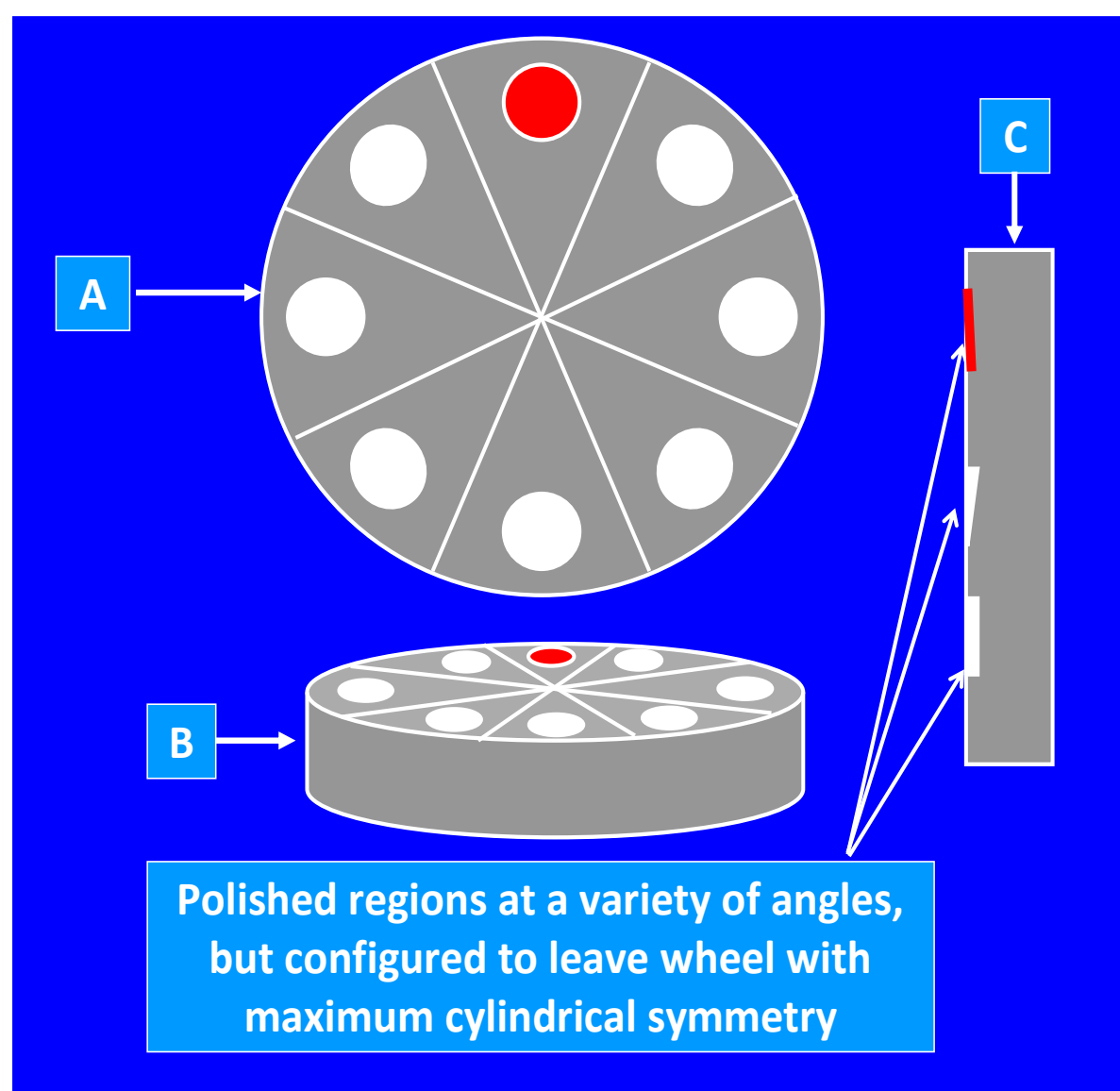
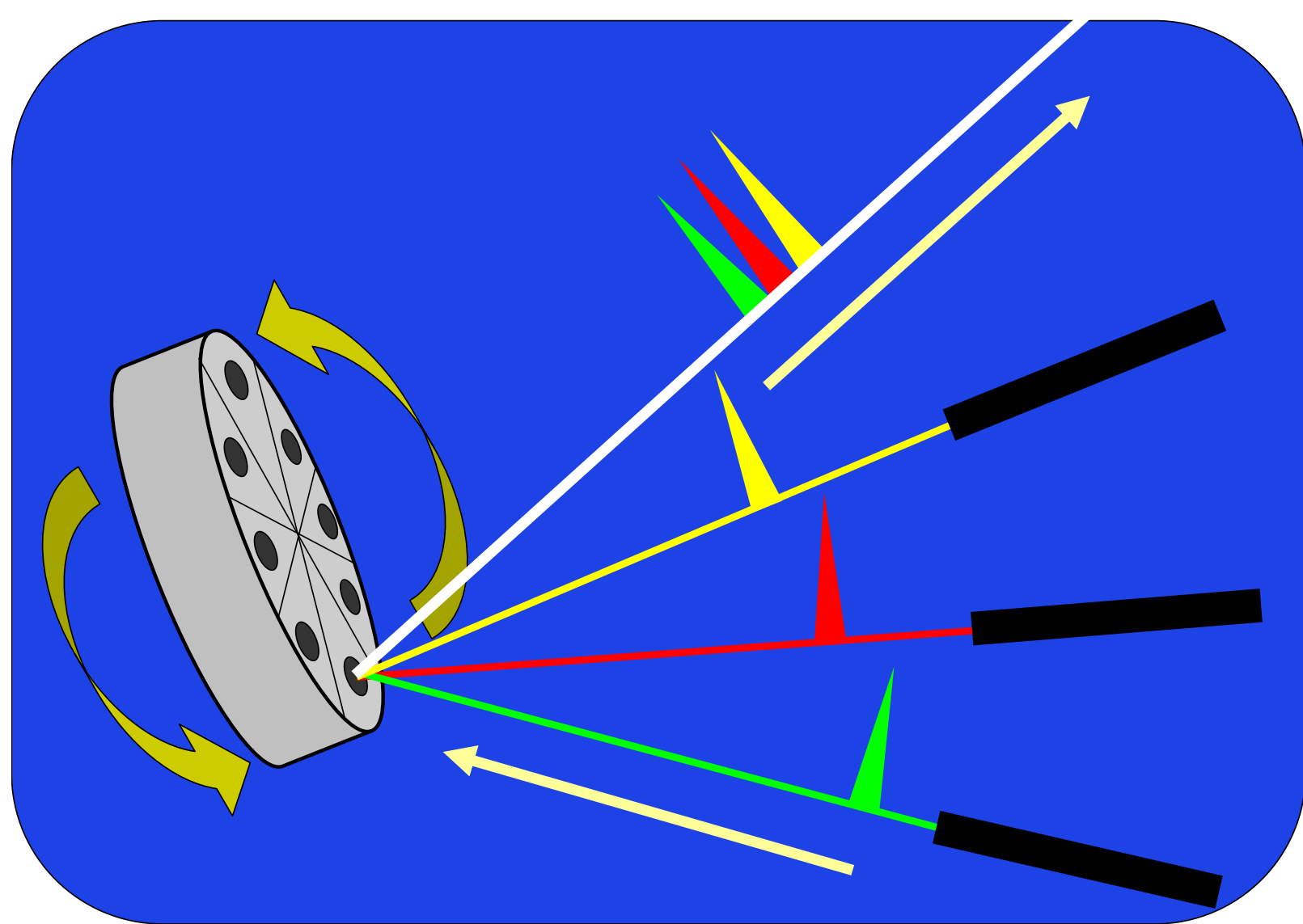
Advancing the Beamed Energy Ablation Driven Propulsion Engine Concept

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Overview

We continue to develop a novel space-based ablation driven propulsion engine concept using transmitted energy between spacecraft in the form of ultra-short optical pulses. We propose a multiplexing strategy involving a modified momentum wheel to act as an optical switch to combine ultra-short pulses along a common optical axis.



A) Front view. B) Angled view. C) Side view. The red reflector illustrates how only a single reflector will be illuminated at a time.

Impact

Multiplexing ultra-short optical pulses from different laser sources can achieve higher average powers while maintaining the high instantaneous pulse power for ablation. This creates new means of providing propulsion and micro-propulsion for new missions in near-Earth space.

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Key Findings

Physical stresses on laser systems maintaining high pulse energies, high repetition rates, and lowest order Gaussian mode beam profiles limit their average power to ~1kW. This suggests that a multiplexing strategy is necessary for producing useful levels of average power for propulsion.

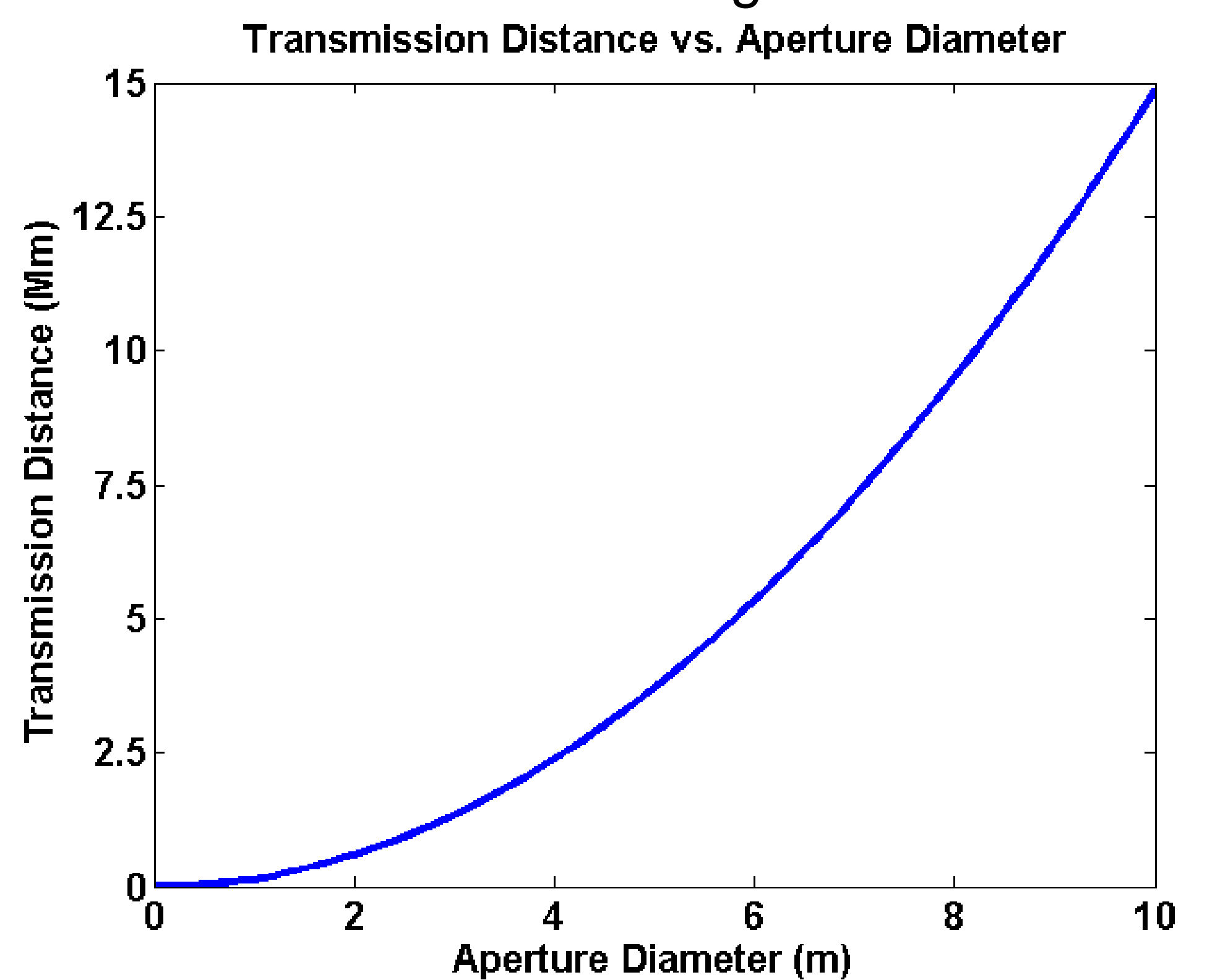
In order to account for diffraction effects causing ripples in the intensity profile in the near and far fields, the diameter of the transmitting mirror must be:

$$d \approx 4.6 \cdot w_m$$

where

$$w_m = \sqrt{\frac{2 \cdot z_R \cdot \lambda}{\pi}}$$

w_m = Beam waist at mirror, z_R = Rayleigh range, λ = Wavelength



Explanation

This research relates to the AAS as it aims to develop novel and efficient strategies for transmitting useful levels of average power between spacecraft for space-based propulsion.