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Projected velocity and efficiency trends for a pulsed fusion magnetic nozzle

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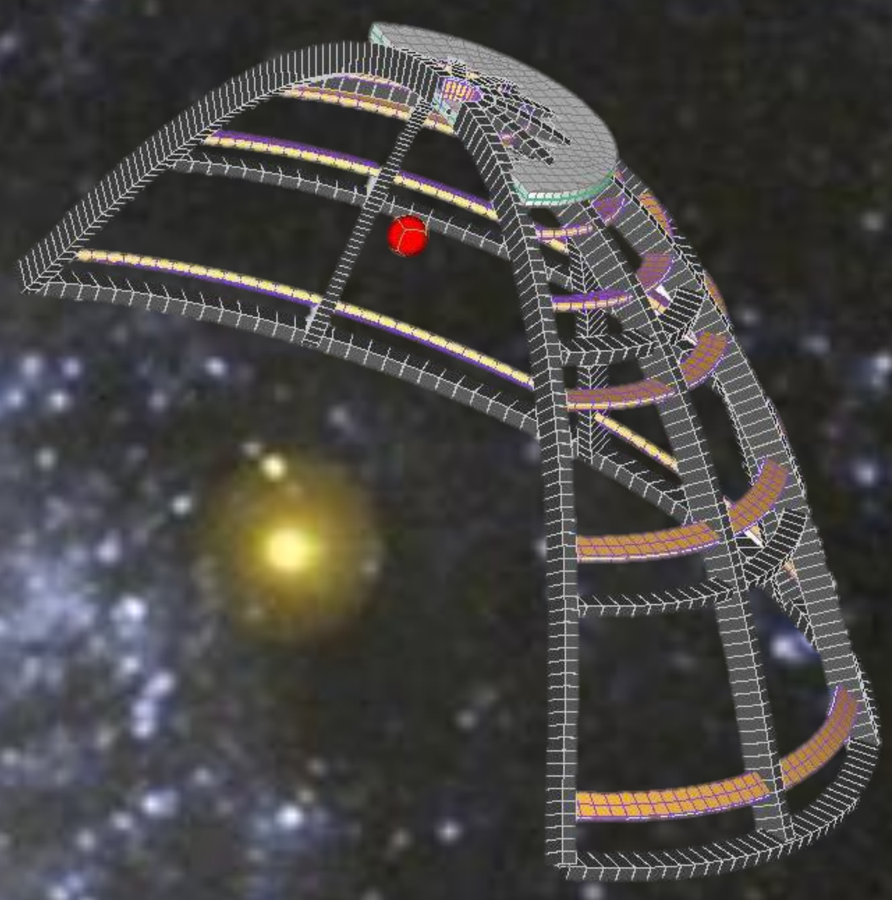
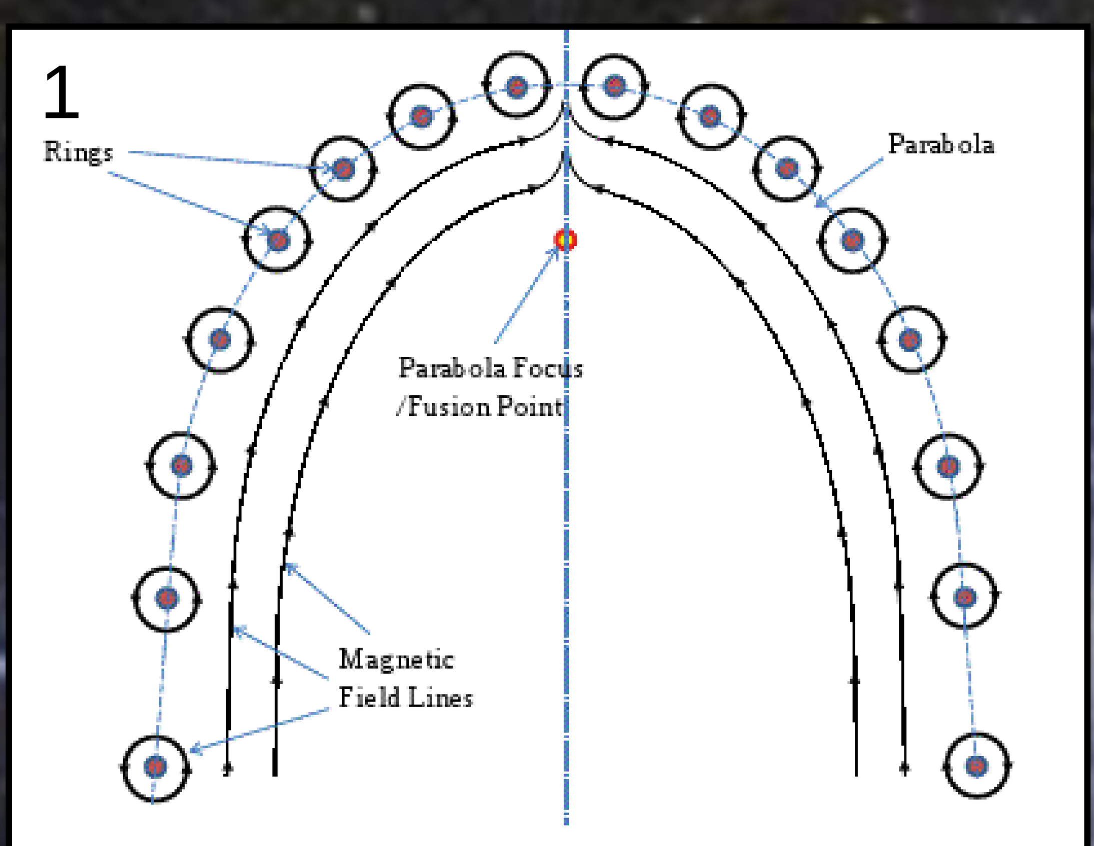
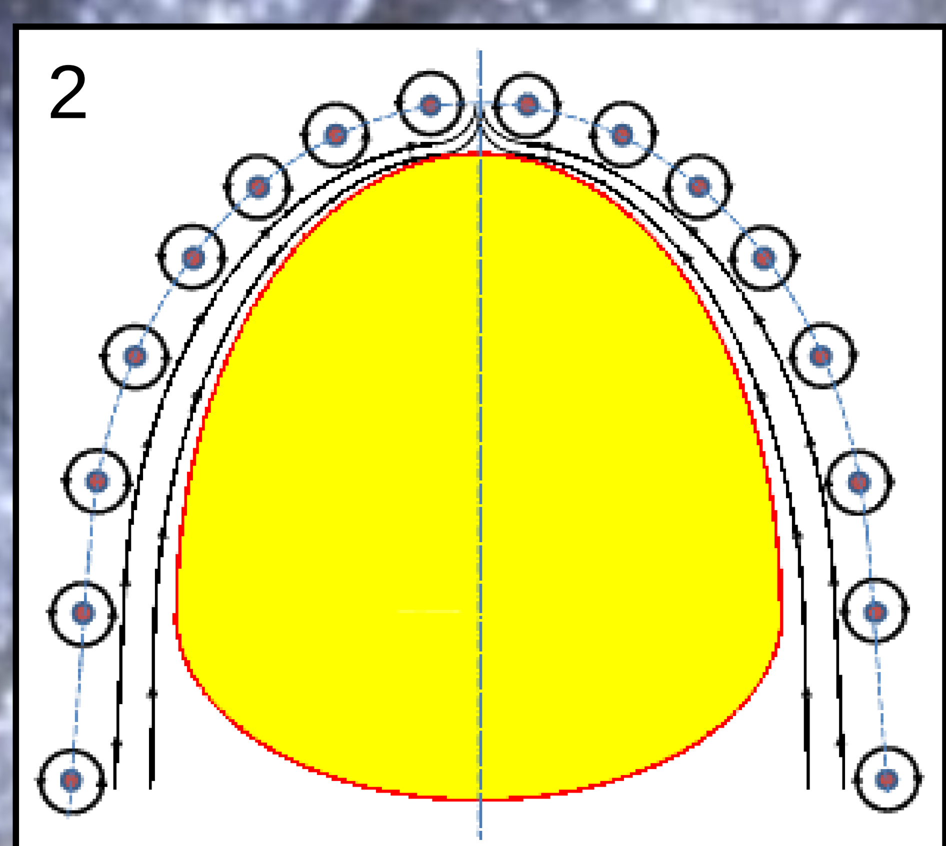
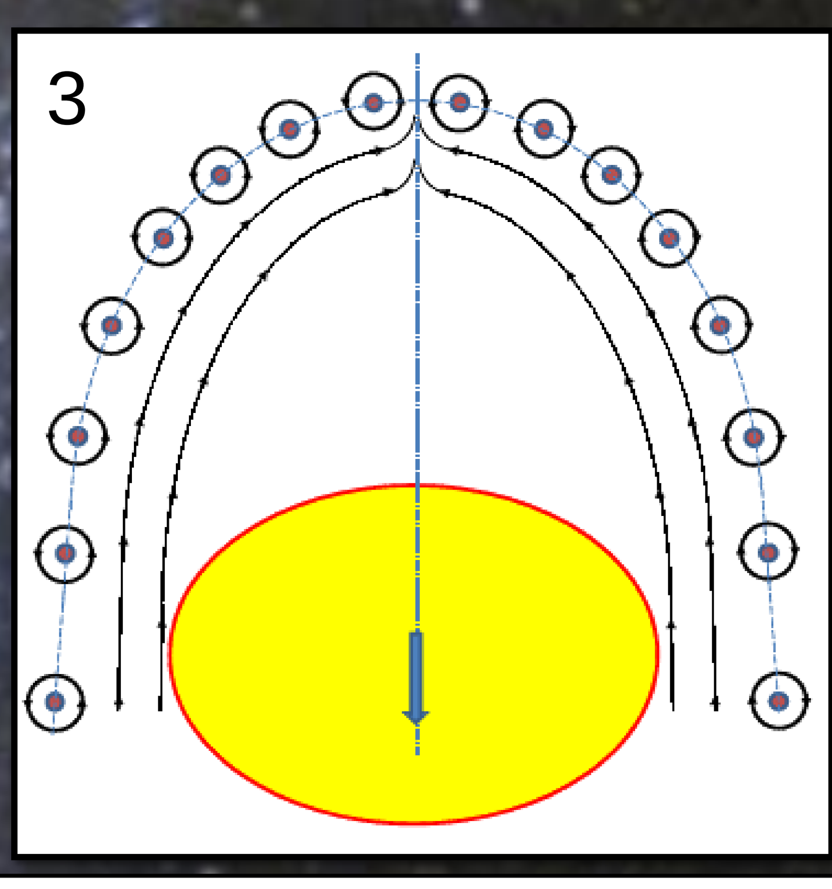


Magnetic nozzle performance will play a key role in the future of deep space exploration by means of nuclear fusion power. This project is designed to show expected performance of a magnetic nozzle assuming a Deuterium – Lithium-6 reaction over a large range of internal energy variations and Mach values.







Assuming adiabatic expansion of plasma

$$\Delta u + \Delta \mathrm{KE} = \not{Q} - W$$

$$u_1 = \frac{3}{2} m R T_1$$

$$W_{12} = \beta u_1$$

Where β is some ratio of u

Assuming no change in kinetic energy from stage 1-2

$$u_2 - u_1 = -W_{12}$$

$$u_2 = \frac{3}{2} m R T_1 (1 - \beta)$$

$$\Delta u + \Delta \mathrm{KE} = \not{Q} - \not{W}$$

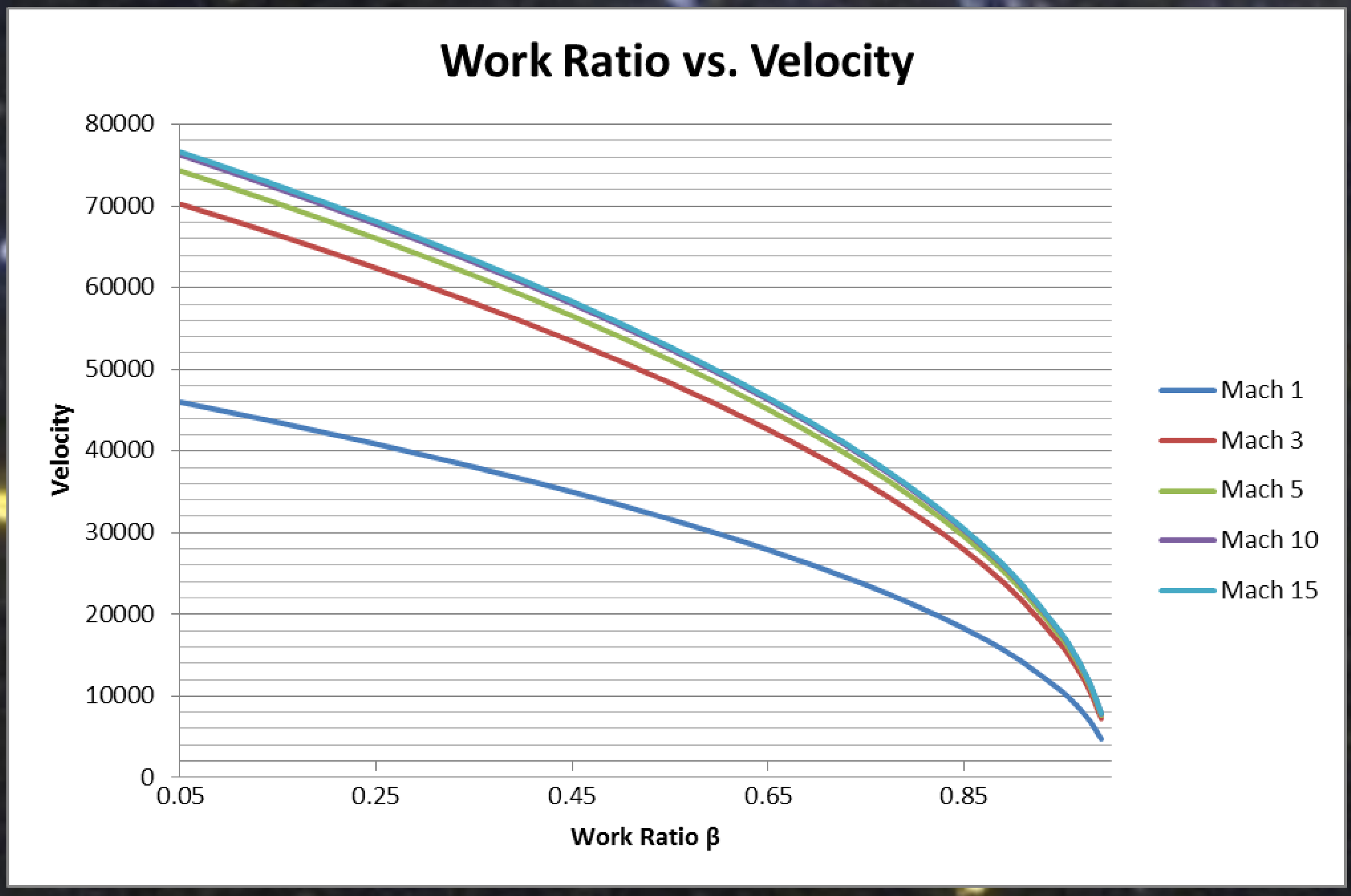
$$u_3 - u_2 + \mathrm{KE}_3 - \mathrm{KE}_2 = 0$$

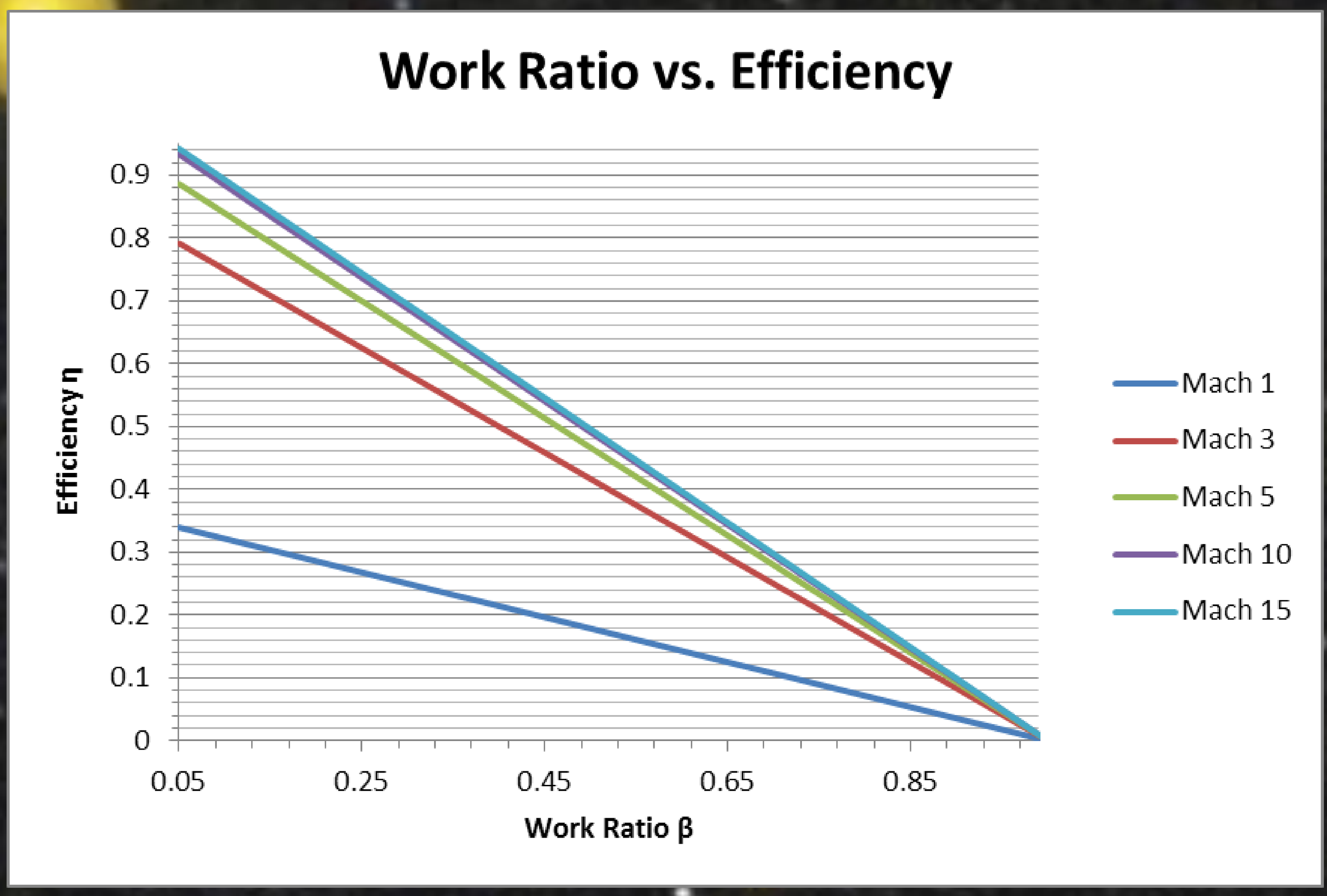
$$\frac{1}{2} m v_3^2 = u_2 - u_3 = \frac{3}{2} m R T_1 (1 - \beta) - \frac{3}{2} m R T_3$$

$$R T_3 = \frac{v_3^2}{\gamma \mathrm{M}_3^2}$$

$$v_3^2 = \frac{3 R T_1 (1 - \beta)}{1 + \frac{3}{\gamma \mathrm{M}_3^2}}$$

$$\eta = \frac{\frac{1}{2} m v_3^2}{\frac{3}{2} m R T_1} = \frac{v_3^2}{3 R T_1}$$





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