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Optimal Navigation in a Plasma Medium

Navigation of a spacecraft in a plasma medium in outer space may need to make use of plasma propulsion in novel ways. It would be desirable if the spacecraft could capture plasma as a propellant, hold plasma, and reject plasma in an arbitrary direction. Plasma can be contained in magnetic mirror traps. What is proposed here is to explore how these mirror traps can be made asymmetrical so that navigational purposes can be accomplished optimally. For example, plasma particles impinging on the trap from one direction can be reflected, while from another direction the plasma is transmitted. Thus operating almost as a Maxwell demon, such a trap would enable the spacecraft to navigate efficiently in a plasma medium. Alternatively, the plasma particles might be heated and rejected for purposes of propulsion, but care can be taken that only monoenergetic and mono-directional particles are expelled, so that the propulsion is accomplished at maximum efficiency. It would be desirable as well to convert plasma heat to work while rejecting electromagnetic radiation, which is not forbidden by thermodynamic constraints.

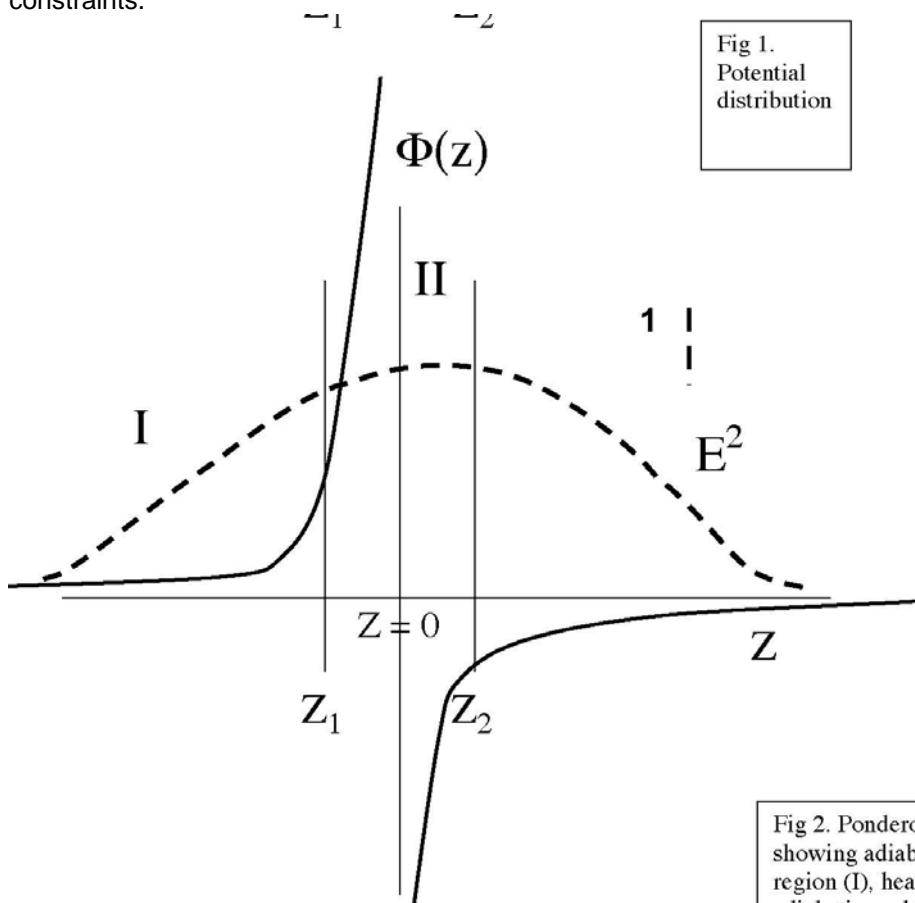


Fig 2. Ponderomotive potential showing adiabatic reflection region (I), heating region (II) and adiabatic sucking in region (III).