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Essential Launching Characteristics of Four Typical Electromagnetic Railguns Launchers

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Abstract : The essential launching characteristics of four typical electromagnetic railguns models were comparatively reviewed referring to the current distribution in conductors. Such four models were as a small conductive simple railgun, the large resistive simple one, the large conductive simple one, and the large conductive complex one. First, according to strict physical theories, a small conductive copper-and-aluminum simple railgun and the proportionally-enlarged big simple railgun with deliberately-designed resistive materials could satisfy the same equations, the similar forms of current distributions, the same temperatures at the corresponding positions, and the same launch velocity, etc. The small model can absolutely express the large one and vice versa. Second, the large resistive simple railgun could launch slightly heaver projectiles to the same velocity than a conductive copper-and-aluminum simple railgun with the same structures. The two have the same temperature distribution on the surfaces at the corresponding positions. The large conductive railgun is a little excellent than the large resistive one, because the conductive one had less Ohmic loss than the resistive one. Third, the large conductive simple railgun carried a mal-distributed current and had a limited launching ability, while, a large conductive complex railgun carried a much even distributed current and had a more powerful launching ability. The conclusion reached were: according to the large resistive simple model as a key reference lever, the small conductive simple railgun was an economic experimental facility to research the launching characteristics of both small and large railguns; the large conductive complex model was a practical railgun model deserving investments for research.

Key words: electromagnetic launching, railguns, scaling method of physical models, practical launcher model

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