optic resonator similar to Fabri-Perot cells. Such an optic resonator needs mirrors with very high reflectance and a powerful light source with a thin line, and all of the optic elements need to be tuned very precisely. For example, in a scheme considered by Kovari *[M. Kovari et al., Fusion Engineering and Design 85 (2010) 745-7511,* the reflectance of the mirrors is required to be not less than 99.96%, the total laser output power is required to be about 800 kW with output intensity of about 300W/cm^2, and the laser bandwidth is required to be less than 100 Hz. It is unlikely that such parameters could be realized together.

[0005] Therefore, it is desirable to provide a non-resonance photo-neutralizer.

SUMMARY

[0006] Embodiments provided herein are directed to systems and methods for a non-resonance photo-neutralizer for negative ion-based neutral beam injectors.

In an aspect, there is provided a non-resonance photo-neutralizer for neutral beam injectors comprising first and second mirrors having opposing mirror surfaces forming a photon trap.

In an aspect, there is provided a negative ion based neutral beam injector comprising a negative ion based neutral beam injector comprising a negative ion source, and a non-resonance photo-neutralizer co-axially positioned with the negative ion source, wherein the photo-neutralizer including first and second mirrors having opposing mirror surfaces forming a photon trap.

The non-resonance photo-neutralizer described herein is based on the principle of nonresonant photon accumulation, wherein the path of the photon becomes tangled and trapped in a certain space region, i.e., the photon trap. The trap is preferably formed as two smooth mirror surfaces facing each other with at least one surface being concave. In the simplest form, the trap is preferably elliptical in shape. A confinement region of the trap is a region near a family of normals that are common to both mirror surfaces of the trap. The photons with a sufficiently small angle of deviation from the nearest common normal are confined. Depending on specific conditions, the shape of the trap may be one of spherical, elliptical, cylindrical, toroidal, or a combination thereof

[0007] In operation, photon beams with a given angular spread along and across the trap are injected through one or more small holes in one or more of the mirrors. The photon beams can be from standard industrial power fiber lasers. The photo neutralizer does not require high quality laser radiation sources pumping a photon target, nor does it require very high precision adjustment and alignment of the optic elements

[0008] Other systems, methods, features and advantages of the example embodiments will be or will become apparent to one with skill in the art upon examination of the following figures and detailed description.