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Feasibility Study of a NBI Photoneutralizer Based on Nonlinear Gating Laser Recirculation

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Low efficiency of gas neutralizers is regarded as a major limit in negative ion NBI for fusion reactor plants, hence the importance in the development of alternative neutralization concepts. Electron photodetachment by means of intense radiation fields is the most promising solution in terms of efficiency (which in principle can reach saturation) and pumping requirements [1]. The standard approach for this type of neutralizer is based on a Fabry-Perot cavity [2]; in this work a different design is analyzed, trying to overcome Fabry-Perot concept criticalities. The present study is based on the RING concept [2], which exploits a lower gain, non resonating cavity for laser beam recirculation. Laser source is positioned outside the cavity, while a non linear medium acts as an optical switch to trap the laser second harmonic within the neutralizer region: with multiple mirrors configuration and with proper cavity geometry it is possible to reach 90% of neutralization rate. Thermal load issues on the second harmonic generator are critical and will be analyzed in detail; requirements on laser sources will be discussed and some proposals will be presented.

References

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