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## Impact of Higher Order QED Correction on the Thermodynamic Topology of Euler-Heisenberg Ads Black Hole

Our presentation is based on the thermodynamic topology of the Euler-Heisenberg-AdS black hole and the higher-order Euler-Heisenberg-AdS black hole. This investigation is carried out by considering the generalized off-shell free energy approach, where black holes are conceptualized as defects in the thermodynamic space. Our study adopts the newly introduced residue method for this purpose. Our primary focus revolved around scrutinizing the influence of varying thermodynamic parameters on the thermodynamic topology of these two black hole systems. For the Euler-Heisenberg-AdS black hole, the topological class differs based on the Euler-Heisenberg parameter, denoted as  $a$ . Specifically, the topological numbers are found to be  $W = +1$  for  $a < 0$  and  $W = 0$  for  $a > 0$ . Remarkably, these topological numbers remained constant irrespective of changes in the thermodynamic parameters. In case of the higher-order Euler-Heisenberg-AdS black hole, the topological class remains same for both negative and positive values of  $a$  at a fixed  $\beta$ , which emerges due to higher-order quantum electrodynamics (QED) corrections. The topological number  $W$  is found to be  $+1$ , which remains same regardless of the change in the thermodynamic parameters. Hence, the introduction of the parameter  $\beta$  had a clear impact on the thermodynamic topology of the Euler-Heisenberg-AdS black hole.

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