# Synchrotron cooling as a progenitor of kinetic instabilities and coherent radiation

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Under the presence of a strong electromagnetic field, charged particles will dissipate their energy through the emission of synchrotron radiation [1]. The resulting radiation reaction force does not conserve momentum space volume as it is dissipative. From fundamental kinetic theory, we demonstrate that plasmas undergoing synchrotron cooling in a strong magnetic field develop an inverted Landau level population. Such distributions have been studied as sources of kinetic plasma instabilities and coherent radiation [2, 3, 4, 5]. We estimate the timescales involved in this process and the emitted radiation spectrum. Particle-in-cell simulations are performed with the PIC code OSIRIS [6] and the OSIRIS-QED module [7, 8]. The simulation results corroborate our theoretical predictions. Our findings are of relevance to coherent radiation emission processes in astrophysical plasmas surrounding compact objects and further stress the relevance of relativistic laboratory masers [9, 10].

## References

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