Interaction Energy Dependence ($\gamma_p\epsilon$)

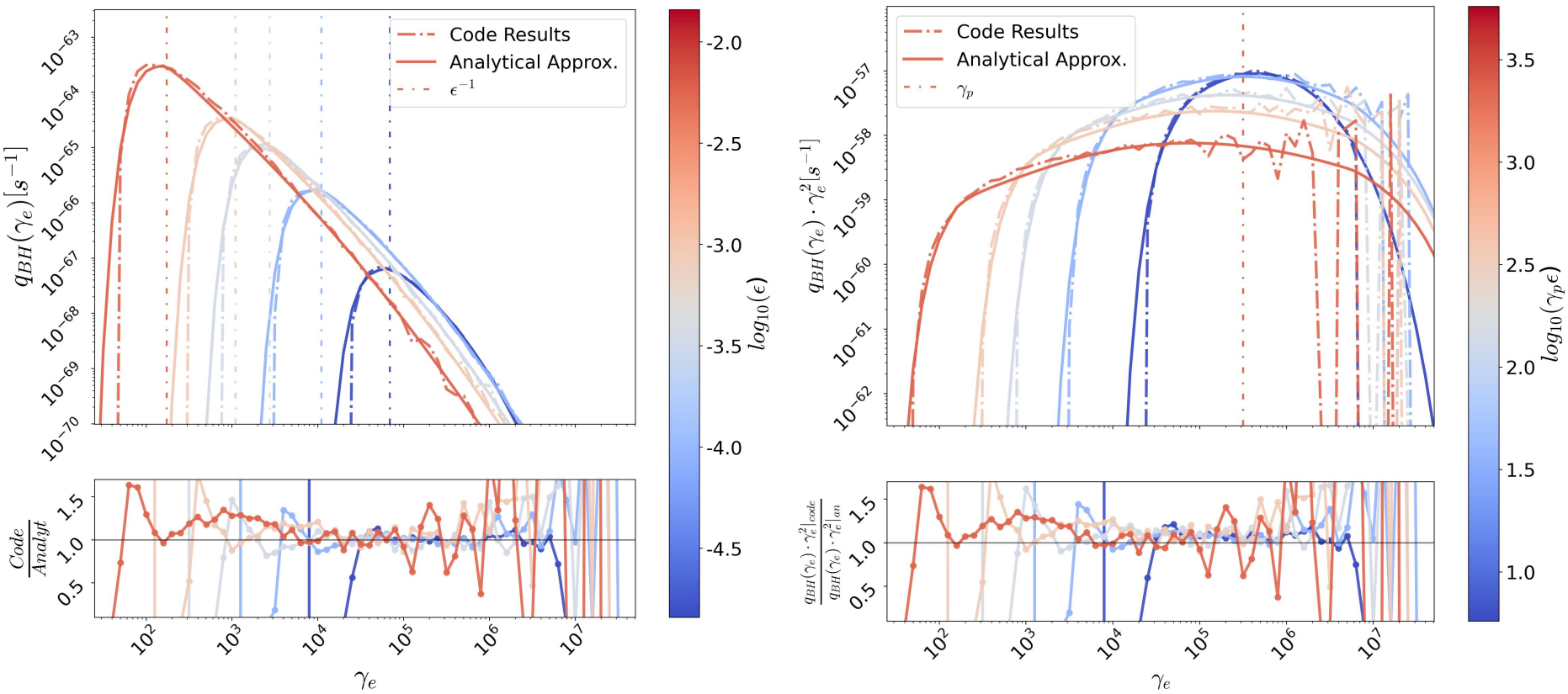

Figure: Comparison between *ATHEνA* leptohadronic code results and the q_{BH} analytical approximation of a single proton of Lorentz factor $\gamma_p \approx 3 \cdot 10^5$ interacting with monoenergetic photons with energies $\epsilon \in [10^{-5}, 10^{-2}]$ (in $m_e c^2$) which translates in $\gamma_p\epsilon \in [2, 10^4]$ (see colorbars). Left plot represents the differential number distribution of produced pairs while right panel displays the energy distribution of the Bh-created population.

Proton Lorentz Factor Dependence (γ_p)

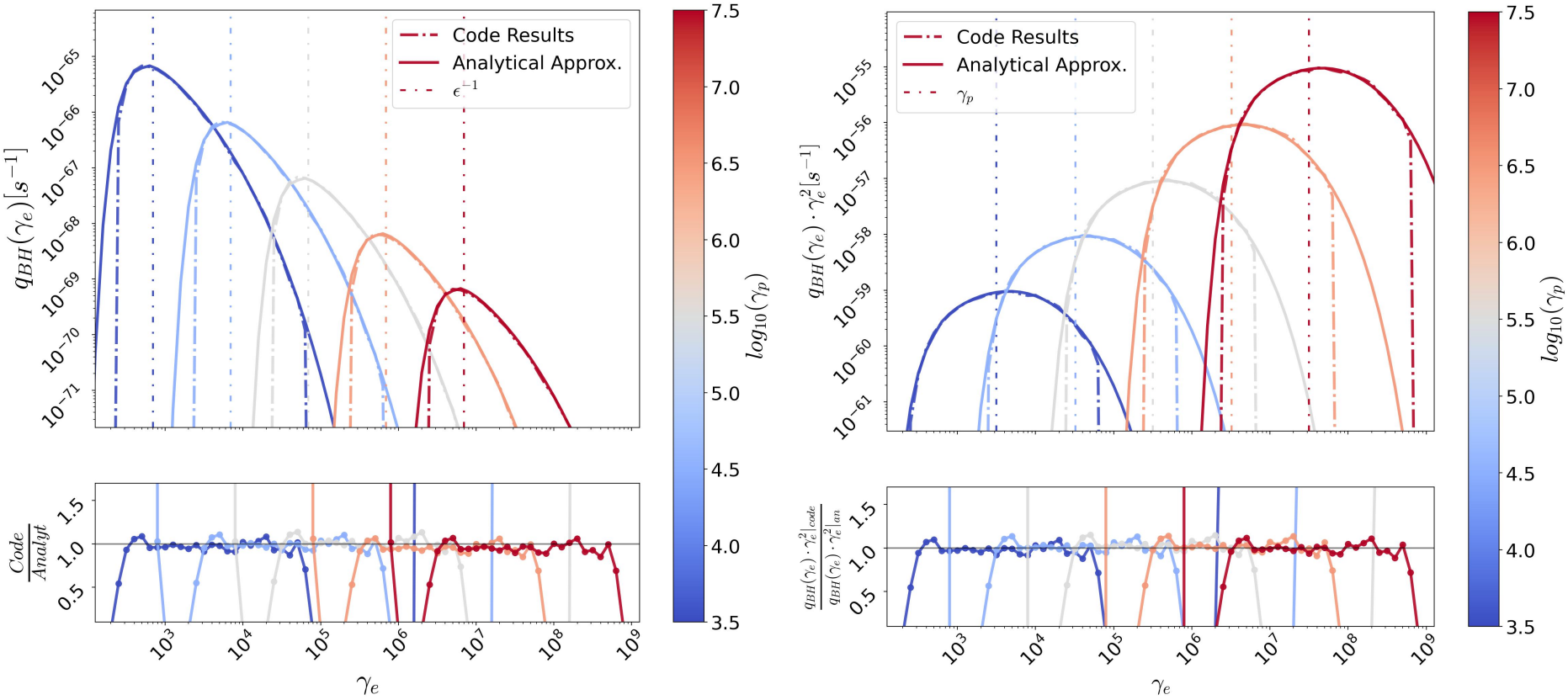

Figure: Comparison between *ATHEνA* leptohadronic code results and the q_{BH} analytical approximation of monoenergetic protons with Lorentz factor values $\gamma_p \in [10^3, 10^8]$ (see colorbar) interacting each with monoenergetic photons with energy adjusted in a way so $\gamma_p\epsilon \sim 5$ (near-threshold interaction). Left plot represents the differential number distribution of produced pairs while right panel displays the energy distribution of the BH-created population.

Power Law Proton And Photon Distributions

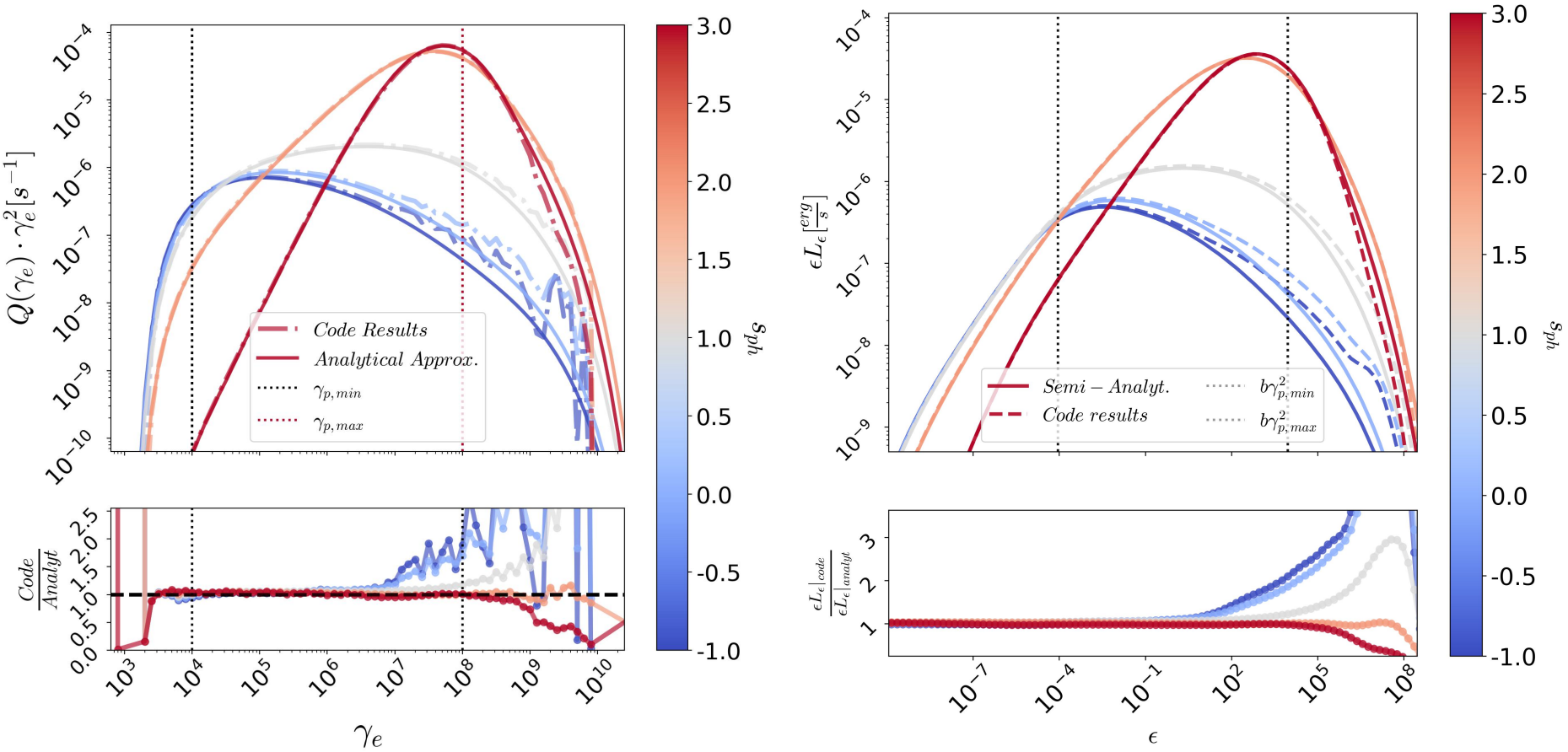

Figure: Comparison between *ATHEνA* leptohadronic code results and the q_{BH} analytical approximation of a power law proton distribution, $n_p \propto \gamma_p^{-2}$, with $\gamma_p \in [10^4, 10^8]$ interacting with a power law photon distribution, $n_{ph} \propto \epsilon^{-s_{ph}}$, with $\epsilon \in [10^{-8}, 10^{-4}]$ (in $m_e c^2$) for various s_{ph} values (see colorbars). Left plot represents the energy distribution of the BH-created population while right plot shows the synchrotron spectra of these populations cooled due to synchrotron radiation.

Power Law Proton And Photon Distributions

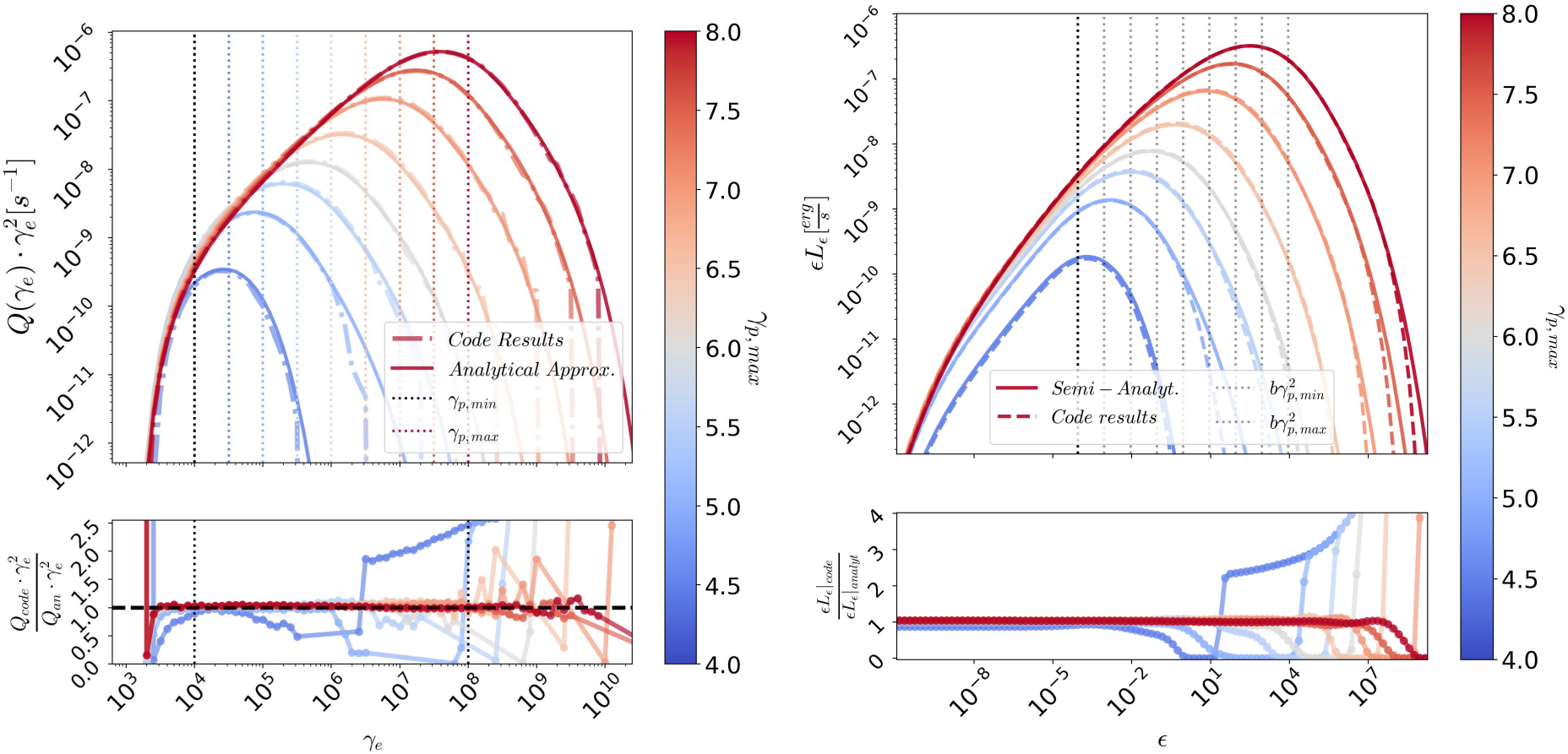

Figure: Comparison between *ATHEνA* leptohadronic code results and the q_{BH} analytical approximation of a power law proton distribution, $n_p \propto \gamma_p^{-2}$, with $\gamma_p \in [10^4, \gamma_{p,max}]$ interacting with a power law photon distribution, $n_{ph} \propto \epsilon^{-2}$, with $\epsilon \in [10^{-8}, 10^{-4}]$ (in $m_e c^2$) for different photon slope values (see colorbars). Left plot represents the energy distribution of the BH-created population while right plot shows the synchrotron spectra of these populations cooled due to synchrotron radiation.