Calculation of the 3C/3D line intensity ratio in Fe XVII\textsuperscript{1} CHARLES CHEUNG, University of Delaware, MIKHAIL KOZLOV, Petersburg Nuclear Physics Institute of NRC "Kurchatov Institute", SERGEY PORSEV, MARIANNA SAFRONOVA, University of Delaware — Some of the brightest X-ray lines in the spectra of many hot astrophysical objects arise from Fe XVII spectra around 15 Å: the resonance line 3C \(([(2p^5)_{3/2}3d_{3/2}]_{J=1} \rightarrow [2p^6]_{J=0})\) and the intercombination line 3D \(([(2p^5)_{3/2}3d_{5/2}]_{J=1} \rightarrow [2p^6]_{J=0})\). These lines are crucial for plasma diagnostics of electron temperatures, elemental abundances, ionization conditions, velocity turbulences, and opacities \cite{1}. However, for the past four decades, their observed intensity ratios persistently disagree with advanced plasma models. We have carried out very large-scale relativistic configuration interaction (CI) calculations of the 3C/3D line intensity ratio, correlating all ten electrons, including Breit and quantum electrodynamical (QED) corrections, for Fe XVII \cite{1}. Using a new parallel version of our CI code, we were able to increase the number of configurations to over 230,000, saturating the computation for all possible numerical parameters. Our theoretical 3C-3D energy difference of 13.44 eV is in agreement with the experiment \cite{1} to 0.3%. The computational advances highlighted in this work are widely applicable and can be used on most elements in the periodic table.


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