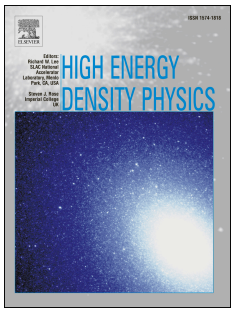
Accepted Manuscript



The effect of first order superconfiguration energies on the opacity of hot dense matter

Menahem Krief, Alexander Feigel

PII: S1574-1818(15)00036-1

DOI: 10.1016/j.hedp.2015.04.003

Reference: HEDP 527

To appear in: *High Energy Density Physics*

Received Date: 10 March 2015

Revised Date: 14 April 2015

Accepted Date: 14 April 2015

Please cite this article as: M. Krief, A. Feigel, The effect of first order superconfiguration energies on the opacity of hot dense matter, High Energy Density Physics (2015), doi: 10.1016/j.hedp.2015.04.003.

The effect of first order superconfiguration energies on the opacity of hot dense matter

Menahem Krief[a], Alexander Feigel[b]

[a] *The Racah Institute of Physics, The Hebrew University, 91904 Jerusalem, Israel*
[b] *Soreq NRC, Yavne 81800, Israel*

Abstract

We have recently completed developing a new super transition array (STA) [1, 2, 3, 4, 5, 6, 7] code for calculating absorption and emission spectra of LTE plasmas. The code follows the theory of Bar-Shalom et al. with various improvements. In this work we focus on the first order correction for the Boltzmann populations for which traditional calculations can be very costly. We present here a method faster by and order of magnitude than the traditional method. We then investigate the effect of this correction on the opacity spectra of several elements. Finally we interpret results of a recent opacity experiment on gold plasma. A good agreement is reached.

Keywords:
opacity, gold opacity, unresolved transition array, super transition array, configuration average energy, first order superconfiguration average energy

1. Introduction

In hot dense plasmas of intermediate or high-Z elements in the state of local thermodynamic equilibrium (LTE), the number of electronic configurations contributing to the opacity can be enormous [8, 9, 10] and the methods of detailed levels [11, 12, 13, 14] and detailed configuration accounting [15, 16, 17, 18, 19] becomes computationally intractable. The method of super-transition-array [1, 2, 3, 4, 5, 6, 7, 20, 21, 22] is a powerful technique to

Email addresses: menahem.krief@mail.huji.ac.il (Menahem Krief), sasha@soreq.gov.il (Alexander Feigel)