A COMPREHENSIVE IR LINE LIST FOR ATOMIC TRANSITIONS ON THE WWW

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ABSTRACT

We discuss a comprehensive line list of atomic transitions with wavelengths ranging from 1 μm to 1000 μm. This list is primarily intended for identifying spectral features.

Key words: Spectroscopy.

1. INTRODUCTION

We have made a compilation of approximately 136,000 allowed and forbidden atomic transitions with wavelengths ranging from 1 μm to 1000 μm. Our primary intention is to allow the identification of observed infrared absorption or emission features. The wavelengths in this list are all calculated from the difference between the energy of the upper and lower level of the transition. No attempt has been made to include observed wavelengths. Almost all of the atomic energy level data has been taken from the Atomic Spectroscopic Database provided by the National Institute of Standards and Technology (NIST).

2. USING THE LINE LIST

When attempting to identify an observed line usually many possible candidates can be found in this list. In order to facilitate narrowing down the number of possible identifications a selection tool has been constructed which allows imposing, apart from the wavelength, several additional criteria. Possible criteria are:

- Select one or more specific elements and/or ions.
- Select only elements above a threshold abundance.
- Select an energy range for the upper and/or lower level.
- Ignore quantum levels with high n and/or l.
- Select a specific multiplet.
- Select only certain types of transitions (allowed, intercombination, forbidden)

3. CONTENTS OF THE LINE LIST

Allowed lines are compiled for all ionization stages of the following elements: H, He, C, N, O, Na thru S, K thru Ni, Cu (except Cu VIII-IX) and Zn (except Zn IX-X, XXVI) and additionally also for the following ions: Li III, Be I, Be IV, B V, F IX, Ne X, Cl XVII and Ar XVIII.

Intercombination lines are compiled for the same ions, provided that the ground state of that ion has at least one electron in the 3p shell.

Forbidden magnetic dipole and electric quadrupole transitions are compiled for all ionization stages of the following elements: C thru Zn (except Cu VIII-IX and Zn IX-X, XXVI).

4. WHERE IS THE LINE LIST ?

The infrared line list can be found on:
www.pa.uky.edu/~peter/line_list/linelist.html

5. FUTURE WORK

In a parallel effort a second line list has been constructed. Using our up-to-date compilation of experimental energy levels, we have calculated accurate wavelengths for a complete list of IR forbidden transitions between the ground term levels of all elements up to zinc (atomic number Z=30) and all isoelectronic sequences up to argon-like ions (number of electrons N=18). In total, this list includes 1200 lines. For these lines, we have compiled and critically evaluated a full set of atomic transition probabilities both from the literature and available atomic databases. We plan to extend this list to other isoelectronic sequences (N>18) and also compile the best available collision strengths for these IR forbidden transition.

It is our intention to combine both line lists and include the transition probabilities in the IR line list presented on the WWW. We also plan to include missing ionic stages in the WWW list whenever the atomic data becomes available.