Equivalent Widths

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Subjects(s): Physics

Topic or Unit of Study: Stars

Grade/Level: 9th grade

Time Allotment: 1 class period – 50 minutes

Objective: Reinforce absorption lines, why they are so important, and learn how to calculate equivalent widths.

Summary: This lesson will start by reinforcing what was learned the day before about equivalent widths – what they are and why they are so important. Then we will learn what equivalent widths are and how to calculate them.

STANDARDS & ASSESSMENT

Standards:

12.F.4a Explain theories, past and present, for changes observed in the universe

12.F.4b Describe and compare the chemical and physical characteristics of galaxies and objects within galaxies

Assessment/Rubrics: Equivalent Widths worksheet

IMPLEMENTATION

Learning Context: This is the 7th lesson of the unit and happens on the 8th day of the unit. In the previous lesson, students will have learned about absorption lines – what they are, how they happen, and how you can use them to find the chemical composition of a star. Now, students will learn that by measuring equivalent widths (which relate directly to absorption lines) and using known measurements for equivalent widths, a star can be classified.

Procedure:

- Review what was learned about absorption lines and ask if anybody has any questions from the reading they still do not understand
- Introduce equivalent widths. Inform the students that equivalent widths are used by real astronomers to classify stars based on the MKK book. It is not important to give a big description of the MKK book. But, it is important to explain that the book talks about equivalent width ratios and when we measure these ratios, we can classify the star.
- Explain that we have equivalent ratios for specific stars already measured, so this can be used to classify stars. Also mention that this work was done by other high school students at Fermilab.
    - If necessary, explain what a ratio is
- Draw on the board an absorption line, which they should be familiar with. Then, draw in the corresponding equivalent width.
    - Do this with a few absorption lines with noticeably different equivalent widths
- Draw another absorption line on the board and go through all of the steps necessary in calculating the equivalent width (actually do the steps as well). Use colored chalk to help emphasize specific steps. An example calculation of the equivalent width for one absorption line is attached. Take all the time necessary to explain all of the steps carefully. Do not write down a step-by-step process on the board, but do write down the equations used for finding σ and EW.
    - Continuum will need to be defined but can be kept very simple. For example, say the continuum is the top of the absorption line, and also write this on the board.
- Pass out the Equivalent Widths worksheet and have students work in small groups to complete it
- Finish Equivalent Widths worksheet for homework

Differentiated Instruction: Students with hearing or visual impairments will be placed in the front of the classroom, enabling them to hear and see the teacher's instruction better. AD/ADHD students will be placed by the teacher's desk or an easily accessible area so the teacher can make sure these students are staying on task. LD students will receive differentiated instruction on a case by case basis. The differentiated instruction will depend on what learning disability the student has and how that specific student will cope with the presented lesson. Furthermore, colored chalk will be used to emphasize important steps for the calculations. This will benefit all learners needed differentiated instruction.

MATERIALS AND RESOURCES

Instructional Materials:

- Colored Chalk
- Equivalent Widths worksheet
- Rulers