

A Theoretical Framework for Understanding Student Conceptions of Quantization

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Overview

- Background of the project
- Data
- Construction of a framework
- Concept map
- Future efforts

Background

- Surveys
- Interviews
- Revisions

Data

- Surveys
- Interviews
- Students
 - Physics-By-Inquiry students
 - Technical students
 - First year engineering students

Construction of a Framework

- Identifying student concepts
- Jim Minstrell's facets
- David May's conceptinos

Facets

Facets are specific student ideas, misconceptions, or errors that pertain to a particular physics idea or physical situation.

E.g., “Heavier objects fall faster.”

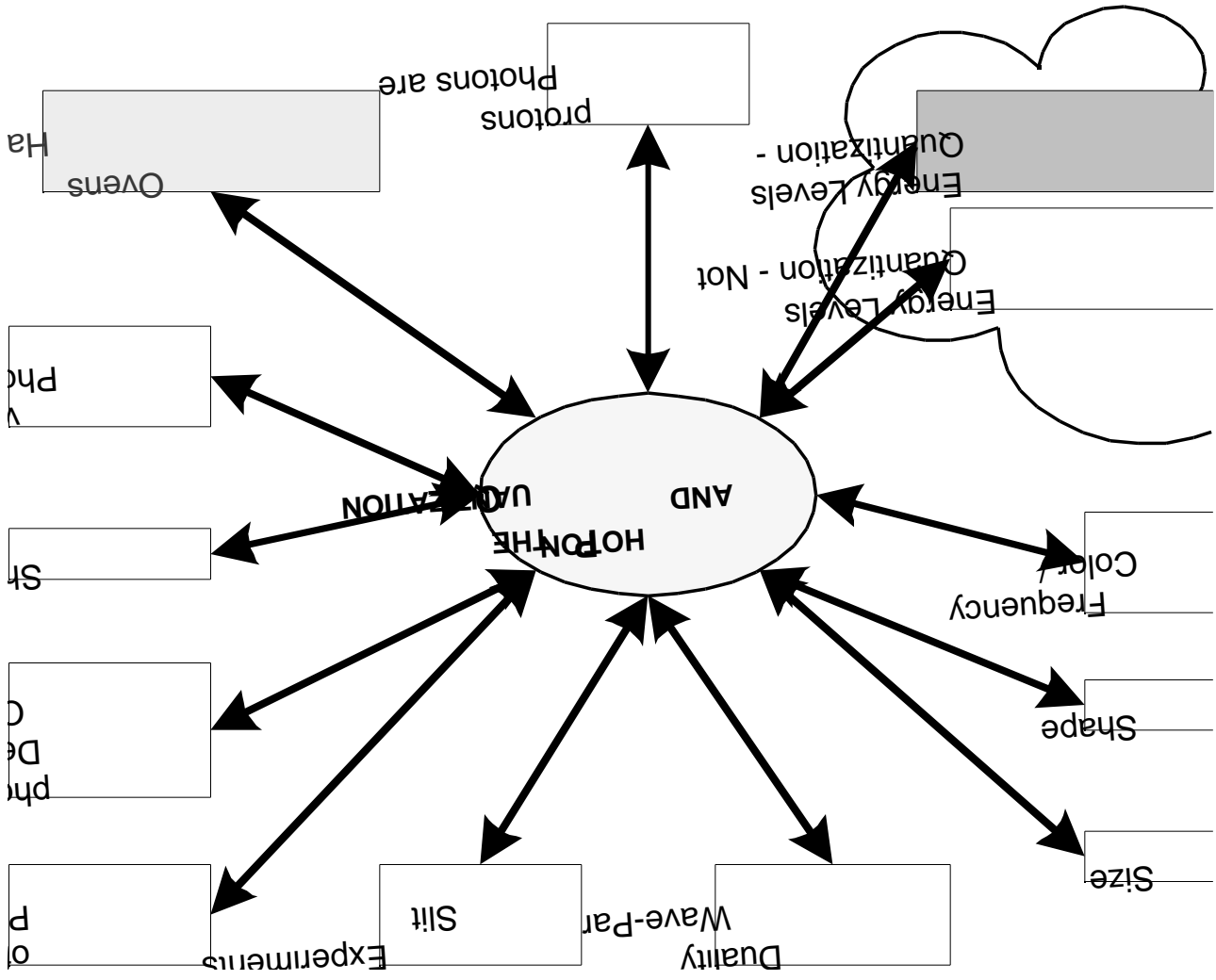
Facets relating to each idea are grouped together, and are ordered according to their “correctness.”

* J. Minstrell, “Facets of students’ knowledge and relevant instruction,” in R. Duit, F. Goldberg, and H. Niedderer, eds., *Research in Physics Learning: Theoretical Issues and Empirical Studies* (IPN: Kiel, Germany, 1992);
J. Minstrell, “Building Facet-Based Learning Environments,” *AAPT Announcer* **29**(2), 131 (1999).

Developing the Framework

- “*Conceptinos*:” dividing survey items and interview transcripts into small ideas. E.g.:
A photon {is a particle} [that carries light].
- *Concept tree*: listing and arranging the ideas fundamental to quantization.

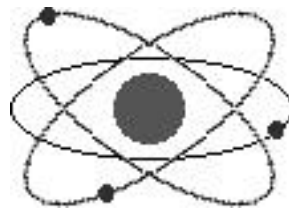
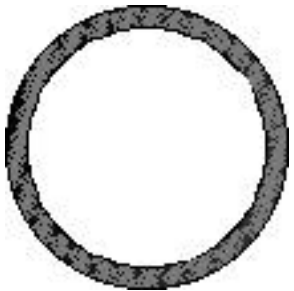
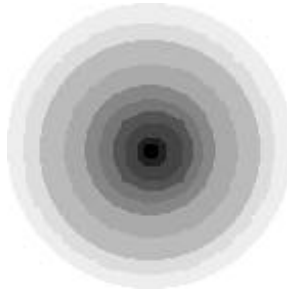
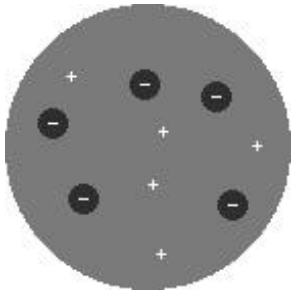
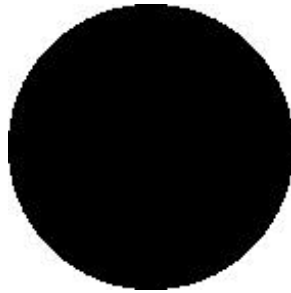
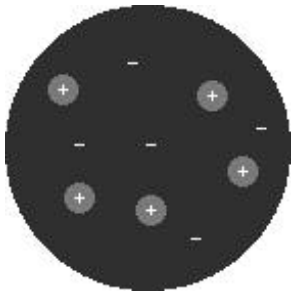
Change of focus:



Concept Map

- Hazards of a microwave oven
- Interviews on atomic energy levels
 - Model of the atom
- Wave versus Particle duality

Atomic Models



Future Efforts

- Continue investigation of atomic energy levels and atomic structure
- Investigate other nodes
 - Calculus-based introductory physics students