Canadian Association of Physicists
Association canadienne des physiciens et physiciennes

Contribution ID: **4245** Type: **Oral (Non-Student) / Orale (non-étudiant(e))**

Bringing Research Literature into the Classroom using the Helium Dimer and an Ultrafast Laser

Monday 27 May 2024 15:00 (15 minutes)

Schöllkopf and Toennies first demonstrated the existence of Helium dimer by making use of matter -wave interference (Journal of Chemical Physics, **104**, 1155 (1996)). The concept of a molecule being comprised of two helium atoms is perhaps a surprise to students, based on their secondary-level chemistry knowledge. The process used by Schöllkopf and Toennies to demonstrate the existence of Helium dimer made use of several physics concepts that are already appreciated by beginner physics learners. Specifically, these are diffraction phenomena, and the de Broglie matter wave relationship. Also, the Heisenberg uncertainty principle can be used to reason about the controversy regarding the existence of the Helium dimer. Our work aims to bridge the experiment carried out by Schöllkopf and Toennies with the physics knowledge already made available to students. We also introduce an analogy between the Helium atoms and molecules using frequency doubled light, as second harmonic light has half the wavelength of its fundamental counterpart, much like Helium atoms have half the mass of the molecules, and thus half the wavelength if the atoms and molecules are travelling at the same speed. The van der Waals bond itself is the conduit to presenting the application of the concepts already appreciated by physics learners. Our presentation introduces to other physics educators the video lessons and instructional materials that we have created to strengthen the link between pedagogy of physics and a specific example from the research literature. Ultimately, this presentation will take listeners on a similar learning journey to that of our target audience of formally educated physics students, and potentially general enthusiasts of physics learning. We hope that this will result in further conversation about "declassifying"interesting physics experiments in a way that can extend physics pedagogy to lifelong learning outside the lecture hall or laboratory classroom.

Keyword-1

Pedagogy

Keyword-2

Introductory Physics

Keyword-3

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Session Classification: (DPE) M2-5 - Case Studies, Writing, Literature, and Reasoning in Physics Education | Études de cas, écriture, littérature et raisonnement dans l'enseignement de la physique (DEP)

Track Classification: Technical Sessions / Sessions techniques: Physics Education / Enseignement de la physique (DPE-DEP)