

Proposal for an Undergraduate Minor in Quantum Science

Context: The physics department currently offers a physics minor and an astrophysics minor. The physics minor currently has very few (if any) active students.

Quantum science is currently an area with high market demand. Anecdotally, prospective first-year physics students (as well as current students majoring in engineering) often express interest in quantum physics. While an eventual undergraduate major in quantum science would be desirable, we can offer a minor with our existing courses. Recent changes to the astrophysics minor have made it more attractive and there has been an increase in enrollment in astrophysics courses. This success indicates demand for physics department minors among the Illinois Tech student population.

Offering a minor in quantum science could serve the following larger purposes:

- Increase enrollment in physics courses
- Increase the marketability of our department to prospective students.
- Serve as testing ground and enrollment feeder for newly developed digital assets (stackable online courses) in areas of quantum theory or applications.

Minors at Illinois Tech: The current language around minors at Illinois Tech is here:

<https://catalog.iit.edu/undergraduate/undergraduate-education/minors/>

In particular: “A minor consists of at least five courses (minimum of 15 credit hours), of which at least four courses (minimum 12 credit hours) are not required for a degree program.”

Proposed Minor in Quantum Science: The minor is intended for a target audience of students with majors outside of physics or astrophysics. It is suggested that we make the minor inaccessible to students majoring in physics or astrophysics as [some other departments have done](#).

- PHYS-224 (or PHYS-223) – 3 (or 4) Credit Hours
- PHYS-405 (Quantum Theory I) – 3 Credit Hours
- PHYS-407 (Quantum Computing) – 3 Credit Hours
- 6 additional credit hours selected from the following list:
 - PHYS-300 (instrumentation lab) – 4 Credit hours
 - PHYS-406 (Quantum Theory II) – 3 Credit hours
 - PHYS-404 (subatomic physics) – 3 Credit hours
 - PHYS-415 (solid state electronics) – 3 Credit hours
 - PHYS-412 (modern optics and lasers) – 3 Credit hours
 - PHYS-427 (advanced lab) – 3 Credit hours
 - PHYS-437 (solid state physics / quantum devices) – 3 Credit hours

Feasibility of the Minor for Engineering Students

We examined program requirements for a few representative engineering programs to see whether the minor would be feasible for such students:

Minor can be accommodated without overloads or transfer credits:

- [B.S. in Electrical Engineering](#): 130-133 credit hours with 12 credits of career electives and 3 credits of free electives. Students could complete their major and this minor in 4 years.
- [B.S. in Mechanical Engineering](#): 127 credit hours with 12 credit hours for free electives and 6 credit hours for technical electives. Students could complete their major and this minor in 4 years.

Minor requires 6-9 credits of overloads, transfer credits, or summer courses:

- [B.S. in Aerospace Engineering](#) 127 Credit Hours with 6 credit hours for free electives and 3 credit hours for technical electives. Students would need 6 credit hours of overload, summer courses, or transfer credits to successfully complete their major and minor in 4 years.
- [B.S. in Computer Engineering](#): 131 – 135 credit hours with 9 credit hours for “career electives”. Students would need 6 credit hours of overload, summer courses, or transfer credits to successfully complete their major and minor in 4 years.
- [B.S. in Chemical Engineering](#): 132 – 133 credit hours with 9 credits of technical electives (but 3 must be used for a CHE course). Students would need 9 credit hours of overload, summer courses, or transfer credits to successfully complete their major and minor in 4 years.

Minor requires significant (9+ credit hours) of overloads/transfer/summer credits:

- [B.S. in Civil Engineering](#): 130 credit hours with 9 credit hours of technical electives, but these are restricted to engineering courses.
- B.S. in biomedical engineering programs: Little room to accommodate technical electives or free electives outside of engineering.